BULLETIN No. 2,

BY WILLIAM C. STUBBS,

PROFESSOR OF AGRICULTURE IN

LOUISIANA

STATE UNIVERSITY

AND A. AND M. COLLEGE,

DIRECTOR SUGAR EXPERIMENT STATION.

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T. J. BIRD, Commissioner,
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The attention of the Farmers and Planters is earnestly invited to the within Bulletin, prepared at my request by Wm. C. Stubbs, Professor of Agriculture in Louisiana State University and A. and M. College, and Director of Sugar Experiment Station.

T. J. BIRD,

Commissioner.

BULLETIN No 2,

OF THE

LOUISIANA SUGAR EXPERIMENT STATION.

KENNER P. O., Jan. 20, 1886.

A trip through this State, with time only for a superficial study of its agriculture, will convince any observant tourist of the small value placed upon manures of every kind by the average planter. Although Louisiana contains some of the finest lands on the continent, and has within its borders the far-famed alluvial bottoms of the Mississippi river and its outlying bayous, yet her decreasing crops point unmistakably to diminished fertility, and plainly proclaim to the thoughtful planter that, if he would restore the original fertility of his soil, or even maintain its present fruitfulness, he must resort to a judicious practice of manuring. There are no soils so fertile that proper fertilizers will not render them more productive. The maximum fertility, the "ultima thule" of soil richness, has never been reached. As well attempt to fill to repletion the exchequer of a miser as to over-fertilize a soil. That it can be improperly fertilized, with a consequent loss or damage to the growing crop, is well known to every agricultural chemist, but properly compounded manures, well applied, will always increase the productive capacity of a soil. That manures pay best upon the best soils is almost an

agricultural maxim, the truth of which is fully realized by every truck grower or gardener. When there is need of manure there is surely a loss of money, labor and animal food to permit it to go to waste or even to cultivate without it, when its application would increase the crop several fold. However, to profitably use manures, they should be properly compounded and rightly applied. Losses may sometimes be greater from *misuse* than from *non-use.* When wrongly compounded and improperly applied, upon badly prepared or ill-conditioned soils, there is always danger of a loss of crops, to say nothing of the rebound of sentiment on the part of the planter. An application of a few well-known scientific facts will correct these faults, and invoke the same intelligence in feeding plants that is now exercised in feeding animals. *Only such fertilizers as are adapted to our crops and our soils* should be used, and a small outlay of money, time and care will determine these, after the fundamental chemical principles underlying all fertilizers are understood. Potash, Lime, Magnesia, Phosphoric Acid, Sulphuric Acid and Nitrogen, (Ammonia,) are the ingredients required in quantities by plants. Iron and Chlorine are used in very limited quantities. Small amounts of Silica and Soda suffice for any plant, if indeed they be needed at all. But these (Iron, Chlorine, Silica and Soda,) are found abundantly in all soils. Magnesia is rarely wanting, while Lime and Sulphuric Acid are generally present in quantities sufficient for most crops. If Magnesia is absent it can be cheaply supplied by Kainit or Kiserite, both products of the Stassfurth (Prussia) mines. When Lime and Sulphuric Acid are absent, they can easily be supplied, the former by Quick-lime (and on the coast by oyster shells,) and both by Land Plaster or Gypsum. Only Nitrogen, Phosphoric Acid and Potash are usually absent from a soil, and it is the object of commercial fertilizers to supply one or more of these ingredients. A soil, however fertile, rarely contains these ingredients in the right proportions and forms for the growth of maximum crops. Per contra, no soil capable of growing vegetation of any kind is usually devoid of any of them, for every plant requires them for growth and devel-

opment. But different soils and different crops require them in different proportions and forms, hence the adaptability of certain crops to certain soils, and the efficacy of rotation of crops upon all soils. A soil may require large doses of Nitrogen to grow small grain, and yet produce a fair crop of cotton without manure. Again some plants have greater feeding capacities than others, and will take their food from apparantly insoluble rock particles and thrive; while other plants, of more delicate organism, require their food in readily assimilable forms, and can live on no other. These ingredients then give value to all manures. Lime, Salt, Gypsum, etc., are often used as fertilizers, but strictly speaking they are not manures *per se.* Their efficacy lies in their power to break down the insoluble compounds, and to render available the material already in the soil. Their use is simply an unnatural method of rapidly exhausting a soil and "enriches the father but impoverishes the son."

HOW CAN THE NEEDS OF A SOIL BE TOLD?

Formerly, chemical analysis was relied upon for the solution of this question. It was believed that a chemist could analyse a soil and prescribe a remedial manure just as a doctor would diagnose a disease and prescribe the appropriate medicine. This, unfortunately, is true only to a limited degree. A chemical analysis of a soil will give negative results when they exist, will reveal small amounts of valuable ingredients, and to this extent is exceedingly useful. But should large quantities of plant food be found, no chemist can tell you when it will be available. Whether plants can utilize it in the next year, the next decade or the next century, is beyond his ken. Again, by a law of nature, the soluble plant food of to-day, if not utilized, becomes the insoluble rock of to-morrow, and vice versa. However, a thorough chemical investigation of a series of soils whose natural growths and agricultural capacities are known, will throw a world of light upon the question of proper manuring, and a comparison of the composition of soils of different fertility may suggest some treatment by which their productive capacity may be enhanced. But such an investigation is tedious and limited in

its application on account of great diversity of soils found sometimes even in the same field. Soil analyses, valuable though they when rightly interpreted by an agricultural chemist, cannot be used alone for telling the needs of our soils.

The analyses of plants was next essayed for the purpose of giving us fixed formulas for fertilizers. It was claimed that if the entire crop grown upon an acre be analysed and exact amounts of each ingredient entering into its composition be determined, then formulas, containing these ingredients, in like quantities and proportions, can be prepared specially suitable for this crop. In this way tables of great value, computed from the results in the laboratory, have been given for each crop. Manures for each crop thus manipulated are offered for sale in many parts of the country. We can obtain a "corn fertilizer," "wheat fertilizer," "tobacco fertilizer," and even an "orange manure." This method of manuring tells us what each plant needs, but it utterly ignores the capacity of our soils and the feeding capacities of plants. Experiments in the field and analyses in the laboratory concur in the following testimony, viz., that different soils furnish unequal amounts of plant food, and different plants possess unlike capacities for extracting this food. The latter is well known to sugar planters. Sugar cane will not thrive upon thin land; cow peas will. Turn in a growth of the latter, either green or after it has decayed, and now the soil will support a healthy crop of cane. The pea gets Nitrogen while the cane will fail for the want of it. Nitrogenous manures are everywhere used for cereals, while they have little or no effect on peas, and this, too, notwithstanding the fact that the pea contains far more Nitrogen than any of the cereals. Peas, with their long deep tap roots, are gross feeders, extracting their food from great depths, while cereals, with their fibrous rootlets delicately organized, must find their food ready formed in the upper layers of the soil. This example shows that an analysis of a green crop does not even show the exact quantities of fertilizing ingredients which will best help its growth.

Formulas for each *class* of plants have also become popular. These are based upon known botanical and chemical relations of plants, and each class is assigned according to its predominant ingredient. The celebrated agricultural chemist, Ville, has thus divided plants, assigned formulas to classes of plants rather than to individuals This system of manuring, when all the factors of growth and character of soils are unknown, is to be commended. But it, too, ignores the food which the soil can furnish, and assigns to the latter the German definition as simply a receptacle for manure. It overlooks the fact that, under proper cultivation, the soil may furnish many of the necessary ingredients contained in the formula. It treats too, all soils alike, forgetful of the fact that they vary in composition according to origin. When from feldspathic granite, Potash predominates; if from animal origin, Lime and perhaps Phosphoric Acid may abound; if of alluvial formation, Nitrogen may be excessive. Again these valuable ingredients are held in every soil in different proportions, and, sooner or later, even our richest soils, under constant cultivation, will be so depleted of one or more valuable ingredients as to check the growth of large crops, while the others may be present in quantity and in readily available forms. Then it is manifestly right to apply to these soils a manure containing only the exhausted ingredients. To apply to them a complete manure, containing all the ingredients of plant food, would most assuredly be a profligate waste. This system of manuring loses sight of the natural strength of a soil and applies manure solely with a view of the needs of the plant. Fortunately the latter, for most of our crops, is quite well determined, but the former can only be determined by

EXPERIMENTS.

Hence the popularity of Experiment Stations, where various crops can be subjected to the crucial soil tests under proper care and system. Only by actual experiments in the field can the wants of our soils be made manifest. Soils vary greatly in composition, therefore we should be slow in accepting the results made on one kind of soil as applicable to another, and here

comes in one of the great values of soil analyses. A simple comparison of the analyses of two soils, (the physical properties being equal,) will at once show whether field results obtained on the one will be applicable to the other. There is then a necessity for individual experimentation. Every farmer or planter shou d conduct yearly a series of experiments upon his crops for himself, results of which, if rightly obtained and interpreted, will be of incalculable benefit. It would ultimately redound to his pecuniary benefit, besides cultivating his powers of observation and reflection, and making him a philosopher and student as well as farmer. Could a series of carefully conducted, inexpensive experiments be yearly made by all our farmers and results carefully reported and compared, an immense sum would be added to agricultural knowledge, and thousands of dollars annually contributed to the general prosperity of the country by the discriminate use of fertilizers.

We trust that a spirit of experimentation will soon be exhibited by our farmers and planters, and that the State of Louisiana will, ere long, be found in the fore-front of the States battling for agricultural progress. To assist those willing to undertake private experiments, directions are given under each crop, and it is earnestly desired that as many as possible will make these field tests and report results to this Department. These results will be tabulated and published in pamphlet form.

COMMERCIAL FERTILIZERS.

The ingredients which give value to all commercial fertilizers are, 1st, Nitrogen, (Ammonia;) 2d, Phosphoric Acid; 3d, Potash. A fertilizer may contain one, two, or all of these ingredients. When all are present, the compound is usually styled a "*complete* manure." When only one or two are present, it is a "*partial* manure."

PARTIAL MANURES

may consist of, (1,) Nitrogen, (Ammonia,) alone; (2,) Phosphoric Acid alone; (3,) Potash alone; (4,) Nitrogen, (Ammonia,) and Phosphoric Acid; (5,) Phosphoric Acid and Potash; (6,) Nitrogen, (Ammonia,) and Potash. No. 6 is rarely found in Southern markets; the others are common wares.

(1.) NITROGEN MANURES.

Nitrogen is the most costly ingredient in manures. It is offered to the trade in three forms:

a—Mineral Nitrogen—in Nitrate of Soda and Sulphate of Ammonia.

b—Animal Nitrogen—in Dried Blood, Tankage, Azotin, Ammonite, Fish Scraps and Leather.

c—Vegetable Nitrogen—in Cotton Seed, Cotton Seed Meal, Linseed Meal, Castor Pomace and Peat.

Blood, Tankage, Fish Scraps and Oil Meals are highly active fertilizers, while Leather and Peat are slowly available. The result of the decomposition of organic forms of Nitrogen is either Ammonia or Nitric Acid; fourteen parts of Nitrogen yielding seventeen parts of Ammonia, or twenty-eight parts of Nitrogen forming, by nitrification, one hundred and eight parts of Nitric Acid. The mineral forms of Nitrogen are highly prized in the North and England, but in the South, on account of the ease with which they are washed from the soil, they should be used with great care.

Cotton seed meal contains, besides Nitrogen, small amounts of Phosphoric Acid and Potash. A fair sample of meal, *free from hulls*, should yield 7 per cent Nitrogen, 3 per cent Phosphoric Acid and 2 per cent Potash. This is a cheap source of Nitrogen, and experiments have demonstrated that it is perhaps the best form for Southern agriculture. In buying it, however, *caution* is necessary to see that it is well decorticated, *i e*, free from hulls. Samples containing 30 per cent of hulls have recently been found on the market.

(2) PHOSPHORIC ACID MANURES.

These are generally phosphatic rocks treated with Sulphuric Acid. Sometimes pure bones or bone black, or bone ash, are treated with the same acid and the resulting mixture styled Dissolved Bones or Superphosphates. When made from phosphatic rock, bone black or bone ash, they contain only Phosphoric Acid. When pure bones are used, 3 to 5 per cent of Ammonia is also found. These phosphatic manures usually contain their Phos-

phoric Acid in different forms. Some of it is readily soluble in water and is highly available as plant food; some of it is soluble only in acids, and is, therefore, only slowly, if at all, available to plants, while another portion is intermediate in solubility between the water soluble and the acid soluble. The chemist uses Citrate of Ammonia to dissolve this form, and hence it is denominated as Citrate Soluble Phosphoric Acid. It is believed by many that this form of Phosphoric Acid has resulted from a chemical action of the water soluble upon the acid soluble, and hence it is often called "reverted," "reduced," etc. The water soluble is readily available on all soils and by all plants; the citrate soluble in soils containing vegetable matter is believed to be available to many plants, while the acid soluble is immediately useful only to certain plants and upon certain soils. The water soluble and citrate soluble are usually taken together and called Available Phosphoric Acid. In buying Phosphatic manures, preference should be given, first, to the water soluble, then to the citrate soluble. If there is much Acid Soluble Phosphoric Acid present, inquiry should be at once made as to its origin, for the Insoluble Phosphoric Acid from bones is more easily transferred into plant food than that from rock. These three forms of Phosphoric Acid are usually called "soluble," "reduced" and "insoluble."

(3) POTASH MANURES.

These are now obtained almost exclusively from Leopolshall and Stassfurth, Germany, and are largely sold in this country as (a) Kainite, which is a crude product of the mines and consists of Potash, Magnesia, Soda, Sulphuric Acid and Chlorine. This form of Potash is now extensively used in the South, either in the compost of stable manure, cotton seed and Acid Phosphate, or mixed with Acid Phosphate and cotton seed meal to form a complete manure. Whether our soils need Potash can only be determined experimentally. After careful experimentation the right quantities can be easily determined. It is a cheap and an excellent source of Potash.

(b) Sulphate of Potash, a refined product containing a large amount of Potash in a very desirable form, is extensively used in some countries upon certain crops, notably tobacco and Irish potatoes. This form is rarely used in the South, though experiments with it upon sugar cane are very desirable.

(c) Muriate of Potash, another refined product containing a large percentage of Potash. This salt furnishes Potash in the cheapest form.

(4) NITROGEN AND PHOSPHORIC ACID.

Formerly bones, treated with Sulphuric Acid, were frequently found upon our markets; recently, however, Potash, in some form, has always been added to them. Whether this addition has been made by the demands of the soil or by the inclinations of the manufacturers, is yet to be determined. Potash is the cheapest ingredient in fertilizers and any demand for it is readily met. At present we find on our markets a manure of this class which is being extensively used under sugar cane, viz: *Tankage.* This is a variable goods, containing usually from 5 to 12 per cent of Nitrogen and from 6 to 20 per cent Phosphoric Acid. The latter is in the insoluble form, but, being of animal origin, upon certain soils are readily available.

(5) PHOSPHORIC ACID AND POTASH.

To make acid phosphates suitable for composting, many dealers have recently added Potash. This addition necessarily lowers the percentage of Phosphoric Acid. Manufacturers in and around Charleston have adopted the custom of calling this class of goods "Acid Phosphates," and those which contain no Potash, "Dissolved Bones." These are extensively used for the compost of stable manure and cotton seed.

(6) NITROGEN AND POTASH.

The great and crying want of Southern soils is Phosphoric Acid; hence no manure without it has hitherto met with favor. Accordingly this class of manures are wanting in the South.

COMPLETE MANURES,

are those which contain Nitrogen, Phosphoric Acid and Potash. For different crops these ingredients should exist in different proportions. They will be discussed for each crop in its appropriate place. Before purchasing any fertilizer, the farmer should study well the wants of his soil and his crop, and buy accordingly.

Before buying, get from the dealers replies to the following questions:

How much Water Soluble Phosphoric Acid do you guarantee?

How much Citrate Soluble Phosphoric Acid do you guarantee?

How much Ammonia do you guarantee?

How much Potash do you guarantee?

In a plain Acid Phosphate at least 12 per cent Available Phosphoric Acid should be guaranteed. In cane fertilizers, 3 per cent Ammonia and 7 per cent Phosphoric Acid, and in cotton fertilizers 2 per cent Ammonia and 8 per cent Phosphoric Acid should be found.

MANURES FOR SUGAR CANE.

The chemical composition of cane varies according to the variety cultivated, the soils upon which it is grown and the maturity of the cane. Varieties differ in the percentages of sugar, woody fibre, albuminoids and mineral matter, (ash.) Hence the advisability of selecting that variety for seed which shall give a maximum of sugar and a minima of other ingredients. In dry sandy lands and localities, cane is smaller but contains more sugar and woody fibre. In damp, rich soils it is gorged with humidity, has less crystallizable and more invert sugar, and is slower in maturing. It is well known that maturity of crop increases saccharose and diminishes glucose. Again, *plant cane* contains less woody fibre than stubble cane. It may, however, be assumed, without much error, that 100 pounds of Louisiana cane contain 75 per cent of water, 10 per cent woody fibre, 14 per cent Sugars, .5 per cent Albuminoids and .5 per cent mineral matter, (Ash.) The top and leaves, which constitute about 30 per cent of the cane gathered, may be estimated to consist in every one hundred parts of 77 per cent of water, 8 per cent woody fibre, 12.25 per cent Sugars and other Carbohydrates, 1 per cent Albuminoids and 1.75 per cent mineral matter, (Ash.) A crop of 25 tons of cane will therefore remove from the soil the following:

37,500 lbs Water.
5,000 lbs Woody Fibre.
7,000 lbs Sugar.

250 lbs Albuminoids.

250 lbs Mineral Matter, (Ash.)

With this crop there would be grown 7½ tons of tops and leaves containing:

11,550 lbs. Water.

1,200 lbs. Woody Fibre.

1,838 lbs. Sugars and Carbohydrates.

150 lbs. Albuminoids.

262 lbs. Mineral Matter, (Ash.)

Only the Albuminoids and Mineral matter have to be supplied in manures, the other substances being fortunately abundantly furnished by air and water. Since Albuminoids contain, on an average, 16 per cent Nitrogen, the 25 tons of cane would contain, of this element, 40 lbs., and the tops and leaves, 24 lbs.

The ashes of cane and of tops and leaves contain the following composition:

	ASHES OF CANE.	ASHES OF TOPS AND LEAVES.
Phosphoric Acid,	6.66 per cent.	1.27 per cent.
Potash,	9.65 "	13.40 "
Lime,	6.44 "	9.04 "
Magnesia,	7.74 "	2 72 "
Silica,	41.50 "	62.10 "
Sulphuric Acid, Iron, Alumina, Soda and Chlorine	28,01 "	11 47 "

Soils usually furnish the above ingredients in great abundance, save Phosphoric Acid and Potash. The former is nearly everywhere needed in the South, while the latter is rarely wanting. We find, then, that to grow a crop of 25 tons per acre of cane with its accompanying leaves and tops, there is withdrawn from the soil, of valuable ingredients, about

64 lbs. Nitrogen.

20 lbs. Phosphoric Acid.

60 lbs. Potash.

If the tops and leaves are returned to the soil without burning, there is removed in the cane

40 lbs. Nitrogen.

17 lbs. Phosphoric Acid.

24 lbs. Potash.

If, however, the tops and leaves are burnt, there is a further loss of 24 lbs. Nitrogen. If possible, the leaves and tops should always be turned under and never burnt, as in the latter case there is a loss per acre of Nitrogen greater than that contained in 300 lbs. of cotton seed meal. Upon a large plantation, this money loss will be great. Again, by incorporating these leaves with the soil, humus is formed, the mechanical effect of which, upon stiff soils, is very beneficial, besides furnishing that "*matiere noir*" which French chemists claim is an indispensable ingredient for the elaboration of sugar. Should the tops and leaves be returned, there must be provided in the manure to reimburse the soil for its expenditure in the making of this cane, 40 lbs. Nitrogen, 17 lbs. Phosphoric Acid and 24 lbs. Potash. It is true, theory would suggest the application of a manure containing these ingredients in above proportions, but experience has demonstrated that under the most propitious seasons only a little more than one-half of the Nitrogen applied in manure is recovered in the crop, the remainder either leaching from the soil or is converted into inert forms.

As a counterpart or offset to this, it may be assumed that the soil itself can furnish the difference needed. Moreover, if seasons and climate permitted a full maturity of the cane, and the only object in view was to obtain a large tonnage, this amount of Phosphoric Acid would probably suffice. But early maturity and an excess of sugar are the grand objects in view, and to attain them, an excess of Phosphoric Acid must be added. It is now well known that this ingredient in excess, and in an available form, hastens the maturity of all plants, and in sugar-producing plants largely increases the content of sugar. It is claimed that an excess of this acid acts physiologically by causing a rapid translocation of the albuminoids through the plant, a quick growth and an early

deposition of sugar. In manures, then, for sugar plants, Phosphoric Acid, in an available form, should largely exist. The prevailing custom of using cotton seed meal alone upon cane, and applying it at the time of planting, is strongly condemned by Agricultural Chemists. The tendency of cane manured with meal is to make a large tonnage, poor in sugar, unless the soil already abounds in Phosphoric Acid, which is rarely the case. Again, the use of any nitrogenous manure alone is attended with loss of Nitrogen, even when distributed with great care and at the proper seasons. Placed alone upon sugar soils in early winter, and subjected subsequently to the heavy rains which always follow, the loss of Nitrogen must be very great. When properly combined, however, with Phosphoric Acid and Potash, the loss is trifling. Therefore cotton seed meal should always be mixed thoroughly with Acid Phosphate and Potash before application. The exact proportions in which these substances should be mixed, can only be demonstrated by carefully conducted experiments, which the Station has already instituted. Pending these results, the Station must be guarded by the light which it has been able to gather from other sources. The results of field experiments made at the Agricultural Station of St. Denis show that the type of manures for cane should contain, at rates of 40 to 70 pounds of Nitrogen per acre, and 70 to 85 pounds of Phosphoric Acid in a readily soluble form and 40 to 80 pounds Potash. This would give us as a suitable formula per acre

600 to 1000 lbs. Cotton Seed Meal.
500 to 600 lbs. Acid Phosphate (14 per cent soluble.)
300 to 600 lbs. of Kainite.

The Director further recommends that the Nitrogen be given it in three forms, viz.:

1st as Organic Nitrogen, e. g. Cotton Seed Meal or Dried Blood.
2d as Ammonical Nitrogen, e. g. Sulphate of Ammonia.
3d as Nitric Nitrogen, e. g. Nitrate of Soda—

using them in the following proportions:

130 to 175 lbs. Sulphate of Ammonia.
85 to 175 lbs. Nitrate of Soda.
120 to 150 lbs. Cotton Seed Meal.

Knowing the full value of Cotton Seed Meal as a fertilizer for cane, and fearing the results of the use of Sulphate of Ammonia and Nitrate of Soda on our Southern soils, the Station hesitates to recommend the above mixture until full trials have been given it. It therefore prefers to recommend all the Nitrogen, as Organic Nitrogen, and this as Cotton Seed Meal. M. Georges Ville, Director at Vincennes, indicates the following as proportions to be used on cane:

	PLANT CANE.	STUBBLE CANE
Nitrogen	29 parts.	37 parts.
Phosphoric Acid	80 "	80 "
Potash	94 "	94 "

This would give for plant cane about the following proportion:

500 lbs. Cotton Seed Meal.
500 " Acid Phosphate.
700 " Kainite.

And for stubble cane:

600 lbs. Cotton Seed Meal.
500 " Acid Phosphate-
700 " Kainite.

Subsequent experiments demonstrated that the Kainite was excessively and injuriously high, and it was lowered considerably with satisfactory results.

The Station feels safe in recommending the following mixture for cane for the present year:

900 lbs. Cotton Seed Meal.
900 lbs. Acid Phosphate, (14 per cent soluble.)
200 lbs. Kainite.

If the soil be rich in vegetable matter, the meal may be slightly decreased, and slightly increased upon stubble in thin lands. Strong objections are urged against mixing fertilizers on the plantation, and many planters will not do it. Fortunately for the latter, the manufacturers of fertilizers will mix for them at a small cost.

Those preferring to mix at home can do so easily on rainy days, under shelter, with hoes.

EXPERIMENTS,

by individual planters, throughout the sugar belt, are earnestly solicited as an invaluable aid to the Station in determining both the needs of the soil and the sugar cane. There is required a small expenditure of money, (which may hereafter save many thousands,) a little well directed care, and one acre of land. Surely any sugar planter can afford these. Select an acre of land of uniform fertility, representing as nearly as possible the body of the plantation; measure off 210 feet each way; lay off 30 rows 7 feet apart, and take 3 rows to each experiment, which will consist of one-tenth of an acre. Open furrows in the middle of each row; distribute the manure as uniformly as possible along the three rows; run a fluke immediately through it to incorporate with the soil, then plant cane, cover and bed on it as usual. Keep a record of time of planting, of subsequent workings and seasons. When ready to gather, cut separately the middle row of each experiment and weigh; multiply by 30 and the weight of cane per acre for each experiment is known. *If possible*, select 3 average stalks from each middle row, number them carefully and send to the Station with name and address. They will be analysed at once without cost to the sender. The Station will furnish printed blanks to any one undertaking these experiments. These blanks, at end of the season, can be filled up carefully with results and returned to the Station. As soon as they are all received, they will be critically examined, tabulated and published in a bulletin. By such action each individual planter will learn the needs of his soil and the Station will learn of the needs of the soils of the sugar belt and of cane. Such results will be of incalculable benefit to the sugar interest of the State.

I append the experiments:

No. 1—Nothing.

No. 2—50 lbs. Cotton Seed Meal.

No. 3—50 lbs. Acid Phosphate.

No. 4—50 lbs. Kainite.

No. 5—Nothing.

No. 6 { 50 lbs. Cotton Seed Meal.
50 lbs. Acid Phosphate.

No. 7 { 50 lbs. Cotton Seed Meal.
50 lbs. Kainite.

No. 8 { 50 lbs. Acid Phosphate.
50 lbs. Kainite.

No. 9 { 50 lbs. Cotton Seed Meal.
50 lbs. Acid Phosphate.
50 lbs Kainite.

No. 10—Nothing

In these experiments, three plats are left without manure to test the natural strength of the soil.

No. 2 will tell how nitrogenous manures alone answer for cane.

No. 3 will answer the same question relative to Phosphoric Acid.

No. 5 the same as to Potash.

No. 6 will tell the effect of a combination of Nitrogen and Phosphoric Acid.

No. 7 will answer the same as to Nitrogen and Potash.

No. 8 the same as to Phosphoric Acid and Potash.

No. 9 will give the results of a combination of all these, or a complete manure.

MANURES FOR COTTON.

Thanks to the Experiment Stations, and to a large class of progressive farmers in the South, the manurial requirements of cotton are well understood The following formula has been used with excellent results all through the South, viz:

700 lbs. Cotton Seed Meal.
1,100 lbs. Acid Phosphate.
200 lbs. Kainite.

This mixture is fully the equal of the best guanos found in our markets, and will cost considerably less. If objection be found to mixing it on the plantation, some of the factories in New Orleans will manipulate it at a small price over cost of materials. The above is recommended with the belief, drawn from a large number of experiments, carefully conducted by the writer, that cotton seed meal is fully the equal of cotton seed as a source of

Nitrogen. Cotton seed ought never to be used as a fertilizer until its oil, *which has no fertilizing value whatever*, is extracted. Every ton of cotton seed yields 35 to 40 gallons of oil, which usually sells at about 30 cents per gallon. Therefore, if all the cotton seed, over and above what is required for planting, could be passed through a mill for the extraction of its oil, and the latter turned into money, what a vast wealth would be added annually to the cotton industry which is now buried with the seed. Unfortunately the present prices of all cotton seed products are low, and, therefore, but little inducement can be offered the farmer by the mills to exchange his seed for meal. The seed now used by the mills are purchased outright, and the products rarely return to the farm upon which the seed was grown. *This is radically wrong.* Cotton, when everything except the lint is returned to the soil, is one of the least exhausting crops, but when the seed are sold to the mills and cattle consume the bolls and stalks left in the field, (as is frequently the case,) it rises high in the scale of exhausting crops, and sooner or later the soils upon which it is continuously grown will reach that point of depletion as to cease to yield remunerative returns without the addition of fertilizers. Whenever the seed go to the mills, the meal and hulls, especially the former, should be returned to the farm with proper care. The Southern cotton planter should buy no Nitrogen. The manure from his domestic animals, reinforced by his cotton seed or cotton seed meal, (should he sell his seed,) ought to grow all his crops. Under no circumstances should stable manure or cotton seed be used alone under cotton. For small grain and corn their use is applicable but not advisable. They should both be

COMPOSTED

with acid phosphate. "The compost is best manure in the world for cotton," is a common declaration among intelligent planters of Georgia and Alabama. There is a power in the combination, a strength in the mixture, a ferment in the union which multiplies roots, enlarges foliage and increases the fruit. The compost, pre-

pared differently for each crop, not only economizes, but properly and effectually utilizes the waste products of the farm, and in its preparation and use there is developed in the farmer powers of observation and reflection hitherto latent. Complete manures or Guanos should not be purchased until all home resources for manure have been exhausted, and only then when its guaranteed constituents are known to be adapted to the soils and crops. Acid Phosphates of a high grade are the best to use in a compost. Below is appended the formula best suited for cotton :

100 bushels Cotton Seed.
100 " Stable Manure.
1 ton Acid Phosphate (High Grade.)

If the above is to be used on very sandy lands, one-half ton of Kainite may be advantageously added. Dissolve in water and use the latter to wet the compost.

Since the success of a compost depends materially upon the proper manner of preparing it, full directions are here inserted :

DIRECTIONS FOR MAKING COMPOST.

Take an equal part of the Stable Manure, say ten bushels, and spread it out in a level place, under shelter, to the depth of three inches Sprinkle over it 100 pounds of Acid Phosphate. Next spread over this ten bushels of Cotton Seed, made thoroughly wet. Then another sprinkle of 100 pounds of Acid Phosphate. Continue this rotation till the quantities are exhausted and then cover with a rich earth, from the fence corners, five inches deep. Permit it to remain until ready for use, (four to six weeks will do,) and cut vertically down with a mattock. Mix well and apply from 300 to 1,000 pounds per acre in the drill at the time of planting.

Be careful to wet the Cotton Seed thoroughly and buy only a first class Acid Phosphate.

EXPERIMENTS

It is highly desirable that experiments in cotton and corn be made in different parts of the State. If, therefore, several planters can be induced to try the experiments on either cotton or

corn, or both, given under cane, they will be accorded similar favors. It is earnestly hoped that a goodly number will undertake them, and that, in a few years, the planters of Louisiana may apply manures to their soils with the same intelligence as is now exercised by the farmers of Georgia.

Any information on this or kindred subjects will be cheerfully given upon application.

MANURES FOR CORN.

Although corn is the cereal crop of the United States, and excels in quantity all others combined, yet its manurial requirements have not been definitely settled. This is due to the fact that it is grown in all kinds of soil and almost in all latitudes. No plant is susceptible of more differentiation under cultivation, there being no end to varieties; in size from the tiny pop corn to the mammoth prolific; in color, from the black Mexican to the purest white, and in hardness from the soft *dent* to the refractory flint. A similar diversity of opinion prevails as to the composition of the manure best adapted to its growth. Mr. Lawes, of England, placing it among cereals, prescribes Nitrogen in heavy doses. M. Georges Ville, of France, assigns it a place among the Phosphoric Acid plants, and recommends for it manures containing a large amount of Acid Phosphate Mr. Harris, in his book, "Talks on Manures," is inclined to place it among cereals, but mentions some facts which would indicate that its feeding capacities are like the pea and clover. Other leading scientific men have given formulas for it, varying largely in cost and in quantities of the chief ingredients. Through the instrumentality of Professor W. O. Atwater, ex-director of the Connecticut Experiment Station, a large number of experiments were tried all over the eastern part of the United States to test the manurial requirements of corn. In his published "Report of Experiments" are given the results, which are far from being satisfactory. Of the 80 results reported, Phosphoric Acid was the regulating ingredient in 29, Potash in 12 and Nitrogen in 4. Phosphoric Acid was more or less effective in 34, Potash in 24, Nitrogen in 4. Phosphoric Acid was indifferent, *i. e.* produced no results, in 17, Potash in 44 and Nitrogen in 46.

One positive conclusion can be drawn from these results, viz.: that the soils operated on varied greatly in composition. This conclusion, however, suggests the propriety of each individual farmer trying experiments upon his own soils. However, in the South, where clean culture has well nigh exhausted our soils of vegetable matter, and where Phosphoric Acid is nearly everywhere wanting, it has been found that both Nitrogen and Phosphoric Acid are imperitively needed in manures for corn. Accordingly the following formulas are recommended:

	No. 1	No. 2
Cotton Seed Meal	1,000 pounds	1,500 pounds.
Acid Phosphate	1,000 "	500 "

No. 1 to be used upon soils of moderate fertility, with a fair quantity of vegetable matter; and No. 2 upon poor soils destitute of vegetable matter.

Instead of above, a compost of
200 bushels Cotton Seed,
200 " Stable Manure,
1 ton Acid Phosphate,
prepared as directed under cotton may be used.

These formulas have given excellent results on corn, under the direction of the writer.

MANURES FOR OATS.

The following formulas have given excellent results:
1,500 lbs. Cotton Seed Meal,
500 lbs. Acid Phosphate,
or a compost consisting of
300 bushels Cotton Seed,
300 " Stable Manure,
1 Ton Acid Phosphate,
prepared as directed under Cotton.

MANURES FOR RICE.

If manures of any kind have ever been used on rice, the Station has failed to notice the results.

Judging, however, from its botanical relations, it should require about the same manure as oats with, probably, a slight decrease in Cotton Seed Meal.

BULLETIN No. 3,

—OF THE—

LOUISIANA

SUGAR EXPERIMENT STATION.

WM C STUBBS, DIRECTOR

KENNER, LA., APRIL, 1886.

Sugar-Bowl print, 6 Camp st., N. O.

BULLETIN No 3

OF THE

LOUISIANA SUGAR EXPERIMENT STATION.

KENNER P. O., April 1, 1886.

In the pause between the planting of the experiments and their after cultivation, it has been deemed expedient to give a summary of the work of the Station since its organization, October, 1885, to date, April 1st.

Transforming a small sugar plantation, in poor condition, to the requirements of an Experiment Station, is a huge task, and the successful accomplishment of such an enterprise in a short time requires a combination of good qualities rarely met with in one individual.

However, this task has been essayed, and it is for the sugar planters of Louisiana to say, by critical inspection, which they are cordially invited to give it at an early date, how far it has been successful.

LABORATORY.

A chemical laboratory, fully equipped with all the most improved facilities for rapid and accurate work has been carefully fitted up, *where analyses of all kinds will be made, free of charge, for all subscribers to the Station.* When time will per-

mit, analyses for outsiders will be made at moderate prices. This laboratory has a furnace room, a working room, a weighing room, a polariscope room, and a small store room. In the furnace room is a two horse boiler, with inspirator and ejector (the latter for elevating water for the filter pumps and general laboratory uses;) water baths, steam baths, drying chambers, a still and combustion and muffle furnaces. In the work room are all the apparatus used in analyses. In the weighing room are balances made by H. Troemner, of Philadelphia. In the polariscope room are French and German polariscopes, the former with monochromatic and white light attachments. The entire laboratory is furnished with gas.

The work in the laboratory has, up to the present time, been confined almost exclusively to analyses of cane juice and its products (results of which will appear in a separate bulletin,) and of various kinds of fertilizers. The analyses of fertilizers will be given later.

The Station is also engaged in the analyses of drainage water from plats differently fertilized, to determine the quantity and quali'y of the loss of manurial ingredients sustained by the sugar soils of Louisiana by the rain percolating through them. The results so far have been very suggestive and promise in the end valuable instruction. In connection with the laboratory we have a weather bureau, with barometer, rain gauge, maximum, minimum, wet and dry bulb thermometers. Three daily observations, at fixed hours, are made and recorded. The results for March are given in Appendix.

The Station is indebted to the U. S. Signal Service for the rain gauge and maximum and minimum thermometers.

In a few weeks the Station will begin the systematic analyses of all the sugar soils of the State, at which time samples of typical soils, with full instructions how to take them, will be solicited.

EXPERIMENTS IN THE FIELD.

Before instituting a regular series of experiments, a large amount of work was necessary in the way of fencing, drainage and preparation of the soil. The ditches on the Station had been sadly neglected, and the soil was accordingly suffering for want of drainage. Besides digging a large number of open ditches, several acres have been underlaid with tile, using the latter of various sizes and at different depths and distances. Upon these tile drained plats, experiments in cane, to test their value and efficiency, have been planted. There are now planted at the Station 454 experiments, viz: 30 in oats, 66 in corn, 8 in sorghum and 350 in cane. On my neighbor's plantation, with his consent and co-operation, the Station has 20 experiments in rice. Experiments in peas, both following the oats and in corn, will be made, and the economy of manuring the peas as a purveyor for the cane, instead of manuring the latter, will be scientifically and practically studied. Attention will also be given next fall to grasses with a view of determining those best adapted to the wants of the sugar planter.

EXPERIMENTS IN OATS.

It was the aim of the Station to plant a plat of oats every month, from October to April, for the purpose of determining the best time, in conjunction with the best manure, for sowing this cereal in South Louisiana. Accordingly, Plat No. 12 of the Station, was broken on 22d and 23d October, manured and planted 27th October, using 2½ bushels red rust proof oats to the acre. The oats, on account of a prevailing drouth, were lightly plowed in with one horse plows.

PLAT NO. 12—OATS.

Experiment	No.	1	30 lbs.	cotton seed meal.
			30 "	acid phosphate.
"	"	2	40 lbs.	cotton seed meal.
			20 "	acid phosphate.
"	"	3	45 lbs.	cotton seed meal.
			15 "	acid phosphate.

Experiment No. 4 { 45 lbs. cotton seed meal. / 15 " acid phosphate. / 30 " kainite.

" " 5 { 40 lbs. cotton seed meal. / 20 " acid phosphate. / 30 " kainite.

" " 6 { 30 lbs. cotton seed meal. / 30 " acid phosphate. / 30 " kainite.

" " 7—30 lbs. cotton seed meal.

" " 8—15 lbs. acid phosphate.

" " 9—15 lbs. kainite.

" " 10 { 30 lbs. cotton seed meal. / 15 " acid phosphate. / 15 " kainite.

" " 11—Nothing.

" " 12 { 30 lbs. cotton seed meal. / 15 " acid phosphate.

A good stand was secured, which successfully withstood the severe freeze January 8–13th. The plats fertilized with cotton seed meal and acid phosphate are, at this date, very fine, the admiration of all who have beheld them.

PLAT NO. 3—OATS.

Broken with four horse plows, harrowed, manured and planted November 17th at rate 2½ bushels per acre; seed, red rust proof, plowed in lightly with one horse plows. Stand excellent, growth vigorous until the freeze (8th–13th January,) killed them completely. Plat re-seeded February 1st and 2d; 2 bushels to acre; stand good; condition fair. Little or no effect yet visible from manures.

Experiment No. 1—50 lbs. cotton seed meal.

" " 2—Nothing.

" " 3 { 50 lbs. cotton seed meal. / 10 " acid phosphate.

" " 4 { 10 lbs. acid phosphate. / 20 " kainite.

" " 5—Nothing.

" " 6 { 50 lbs. cotton seed meal. / 20 " kainite.

" " 7—10 lbs. acid phosphate.

Experiment No. 8—Nothing.
" " 9—20 lbs. kainite.
" " 10 { 50 lbs. cotton seed meal. / 10 " acid phosphate. / 20 " kainite.
" " 11 Nothing.
" " 12 { 50 lbs. cotton seed meal. / 10 " floats. / 20 kainite.

This plat is upon a blacker and stiffer soil than Plat No. 12.

PLAT NO. 13—OATS.

Broken with two horse plow, harrowed, manured and planted January 30th. Oats (2 bushels to acre) plowed in with one horse plows. Stand excellent; growth vigorous. Land sandier than either Plats 12 or 3.

Experiment No. 1 { 25 lbs. cotton seed meal. / 25 " Orchilla phosphate. / 12½ " kainite.
" " 2 { 25 lbs. Orchilla. / 12½ " kainite.
" " 3—25 " Orchilla.
" " 4 { 25 lbs. cotton seed meal. / 25 " Charleston floats. / 12½ " kainite.
" " 5 { 25 lbs. Charleston floats. / 12½ " kainite.
" " 6—25 " Charleston floats.

Intending to follow oats with peas, this plat has been manured with special reference to the latter, testing how far oats will be benefitted and what the residue will accomplish for peas. Floats and kainite constituted the "ash element" of the late Dr. Ravenel, which in his hands proved such an excellent manure for peas.

A valuable conclusion can be drawn from our experience with oats, viz: those sown early enough to have formed a good root developement were not injured by the freeze; all others were. Those sown November 17th were killed outright while those sown October 27th were unhurt.

EXPERIMENTS IN CANE

May be divided into several classes: 1st—Germination questions; 2d—Physiological questions; 3d—Varieties, and 4th—Manurial requirements.

PLAT 0 — CANE.

(First—Germination Questions.)

This plat was devoted to testing the best part of the cane to plant, as well as the quantity to the row. Accordingly great pains were taken to select stalks of uniform length, which were cut up into short pieces, beginning with the green, immature top.

Experiment No. 1—Planted with green tops usually thrown away.
" " 2—2 joints next to top (green.)
" " 3—Next 2 joints (partially green.)
" " 4— " " "
" " 5— " " "
" " 6— " " "
" " 7— " " "
" " 8— " " "
" " 9—2 Butt joints.
" " 10—Upper thirds of the cane.
" " 11—Middle "
" " 12—Butt "
" " 13—1 cane with lap.
" " 14—2 "
" " 15—3 "

The severe weather and late spring will probably prevent accurate results.

PLAT NO. 11—CANE.

(Second—Physiological Questions.)

This plat runs east and west, and was selected to try the experiment of orientation, and also the question of suckers. It was manured like several adjacent pieces running north and south. Planted February 18th:

Experiment No. 1—Orientation.
" " 2—All suckers left.
" " 3—No suckers left.
" " 4—Only such as covered by plow removed.

PLAT NO. 00—CANE

(Third Varieties.)

Early in the fall planters throughout the State were requested to send to Station a few selected cane of the different varieties

grown by them. The object was to test whether, by selection and proper manuring, an improved variety could not be permanently developed. The following have been received:

No. 1.	Selected	red cane, from Ashland plantation, Kenner & Brent.	
" 2.	"	striped Mexican " "	
" 3.	"	white La Pice " "	
" 4.	"	Japanese, from Tchoupitoulas plantation, Soniat Bros.	
" 5.	"	small red, " "	
" 6.	"	striped, " "	
" 7.	"	bastard, " "	
" 8.	"	large red, " "	
" 9.	"	large red and striped, from Station.	
" 10.	"	large red, from Cypremort, St. Mary, J. M. Burguieres.	
" 11.	"	yellow ribbon, Port Hickey, W. S. Slaughter & Bros.	
" 12.	"	red " "	
" 13.	"	red, from Baton Rouge, S. Shorten.	
" 14.	"	red, from Homestead, Dr. Wm. E. Brickell.	
" 15.	"	ribbon " "	
" 16.	"	Bourbon, from Cuba, D. D. Colcock.	
" 17.	"	red, from Homestead, Dr. Wm. E. Brickell.	
" 18.	"	red (tops), " "	
" 19.	"	yellow La Pice, from H. A. LeSassier.	

The other plats of cane were devoted to the *manurial requirements* of cane.

PLAT NO 1—CANE.

(Fourth—Manurial Requirements.)

Land broken October 6–9, with four horse plow; harrowed and planted Oct. 16 and 17. Divided into 28 plats, and left to be manured in spring, after cane was up, with same manures as used upon the first 28 experiments in Plat No. 2, the object being to test difference between fall and spring manuring upon fall plant cane. The north end of plat No. 1 was broken, harrowed, manured and planted November 30 and December 1–3.

Experiment No. 1–28, see Plat No. 2, 1–28.

" " 29 $\begin{cases} 32\frac{1}{2} \text{ lbs. cotton seed meal.} \\ 5 \text{ " acid phosphate.} \\ 12\frac{1}{2} \text{ " kainite.} \end{cases}$

" " 30 $\begin{cases} 30 \text{ lbs. cotton seed meal.} \\ 7\frac{1}{2} \text{ " acid phosphate.} \\ 12\frac{1}{2} \text{ " kainite.} \end{cases}$

31—Nothing.

" " 32 $\begin{cases} 25 \text{ lbs. cotton seed meal.} \\ 12\frac{1}{2} \text{ " acid phosphate.} \\ 12\frac{1}{2} \text{ " kainite.} \end{cases}$

" " 33 Nothing.

Experiment No. 34	18¾	lbs.	cotton seed meal.
	18¾	"	acid phosphate.
	12½	"	kainite.
" " 35	15	lbs.	cotton seed meal.
	22½	"	acid phosphate.
	12½	"	kainite.
" " 36	15	lbs.	cotton seed meal.
	25	"	acid phosphate.
	30	"	kainite.
	18	"	gypsum.
" " 37	15	lbs.	cotton seed meal.
	25	"	acid phosphate.
	15	"	kainite.
" " 38	Nothing.		
" " 39	50	lbs.	lime.
	25	"	cotton seed meal.
	25	"	floats.
	12½	"	cotton hull ashes.

The object of experiments Nos. 29 to 35 is to test the proportion of nitrogen to phosphoric acid suitable for cane on black land; using them from 3 of former to 1 of latter in No. 29, to 1 of former to 3 of latter in 35. Nos. 36 and 37 are Ville's formulas for cane, modified one with and the other without gypsum. No. 39 was first top dressed with 50 lbs. lime and then treated with rest of formula. This cane was planted during a prevailing drouth and some apprehension exists of danger therefrom.

PLAT NO. 2—CANE.

Ground prepared with four horse plow. Harrowed manures put out and cane planted October 19th. Ground very hard. This plat was manured in fall, while a portion of plat No. 1 is intended to be similarly manured in the spring.

Experiment No. 1	10	lbs.	cotton seed meal.
	5	"	acid phosphate.
" " 2	16⅔	"	cotton seed meal.
	8⅓	"	acid phosphate.
" " 3	Nothing.		
" " 4	23⅓	lbs.	cotton seed meal.
	11⅔	"	acid phosphate.
" " 5	30	"	cotton seed meal.
	15	"	acid phosphate.
" " 6	30	"	cotton seed meal.
	15	"	acid phosphate.
	15	"	kainite.

Experiment No. 7—	30	lbs.	cotton seed meal.
" " 8—	Nothing.		
" " 9	15	lbs.	acid phosphate.
	15	"	kainite.
" " 10—	15	"	kainite.
" " 11	10	"	cotton seed meal.
	5	"	floats.
" " 12	$16\frac{2}{3}$	"	cotton seed meal.
	$8\frac{1}{3}$	"	floats.
" " 13—	Nothing.		
" " 14	$23\frac{1}{3}$	lbs.	cotton seed meal.
	$11\frac{2}{3}$	"	floats.
" " 15	30	"	cotton seed meal.
	15	"	floats.
" " 16	30	"	cotton seed meal.
	15	"	floats.
	15	"	kainite.
" " 17	30	"	cotton seed meal.
	15	"	floats.
	15	"	kainite.
	10	"	gypsum.
" " 18—	Nothing.		
" " 19	30	lbs.	cotton seed meal.
	15	"	floats.
	15	"	cotton hull ashes.
" " 20—	15	"	tankage.
" " 21—	25	"	tankage.
" " 22—	35	"	tankage.
" " 23—	Nothing.		
" " 24—	45	lbs.	tankage.
" " 25	45	"	tankage.
	15	"	kainite.
" " 26	45	"	tankage.
	15	"	kainite.
	10	"	gypsum.
" " 27	45	"	tankage.
	15	"	cotton hull ashes.
" " 28—	Nothing.		
" " 29—	85	lbs.	cotton seed.
" " 30	85	"	cotton seed.
	15	"	acid phosphate.
" " 31	85	"	cotton seed.
	15	"	acid phosphate.
	15	"	kainite.
" " 32	85	"	cotton seed.
	15	"	cotton hull ashes.
" " 33—	Nothing.		

Experiment No. 34 { 85 lbs. cotton seed. / 15 " floats.

" " 35 { 85 " cotton seed. / 15 " floats. / 10 " gypsum.

" " 36—stable manure.

" " 37 { stable manure. / 15 lbs. acid phosphate.

" " 38—Nothing.

" " 39 { stable manure. / 15 lbs. acid phosphate. / 15 " kainite.

" " 40 { stable manure. / 15 lbs. floats.

This plat is coming up quite well, and hopes are entertained of a good stand.

SPRING PLANTING.

PLATS 4 AND 5.

These plats lie side by side, running north and south, with no visible marks to indicate the one from the other. They are of the same size. No. 5 is tile drained ; No. 4 is not. The plats are naturally low, and very stiff and black. Duplicate experiments have been made on each to test the advantage of tile drained over untiled. They were planted on 15th and 16th February. The following are experiments upon each :

Experiment No. 1 { 25 lbs. cotton seed meal. / 25 " acid phosphate. / 25 " kainite.

" " 2 { 25 " cotton seed meal. / 25 " acid phosphate.

" " 3—Nothing.

" " 4 { 25 lbs. cotton seed meal. / 25 " Orchilla phosphate. / 25 " kainite.

" " 5 { 25 " cotton seed meal. / 25 " Orchilla phosphate.

" " 6—Nothing.

" " 7 { 25 lbs. cotton seed meal. / 25 " bone dust. / 25 " kainite.

Experiment No. 8 { 25 " cotton seed meal.
25 " bone dust. }

" " 9—Nothing

" " 10 { 25 lbs. cotton seed meal.
25 " floats.
25 " kainite. }

" " 11 { 25 " cotton seed meal.
25 " floats. }

" " 12—Nothing.

" " 13 { 25 lbs. cotton seed meal.
25 " ashes cotton hulls.
25 " kainite. }

" " 14 { 25 " cotton seed meal.
25 " ashes cotton hulls. }

" " 15—Nothing.

" " 16—25 lbs. cotton seed Meal.

" " 17—25 " acid phosphate.

" " 18—25 " kainite.

In these experiments we have sought to test the value particularly of different forms of phosphates with and without kainite, using cotton seed meal as our form of nitrogen in every instance.

NITROGEN MANURES—PLAT 6.

This plat is tile drained, the tiles running east and west, while the different forms of nitrogen were applied north and south, so that whatever leaching might occur from each nitrogen group could be caught and analysed. This, to date, has been four times successfully accomplished, results of which will constitute the matter of a separate bulletin.

GROUP 1—FORMS OF NITROGEN ALONE.

Experiment No. 1—5 lbs. nitrate soda.

" " 2—3¾ " sulphate of ammonia.

" " 3—Nothing.

" " 4—7½ lbs. dried blood.

" " 5—12 " cotton seed meal.

GROUP 2—NITRATE OF SODA.

Experiment No. 6 { 15 lbs. acid phosphate.
4 " muriate patash.
*Mixed minerals. }

---

*Mixed minerals in this plat always mean 15 lbs. acid phosphate and 4 lbs. muriate potash.

Experiment No. 7 { Mixed minerals.
5 lbs. nitrate soda, equal to ⅓ ration.

" " 8—Nothing.

" " 9 { Mixed minerals.
10 lbs. nitrate soda, equal to ⅔ ration.

" " 10 { Mixed minerals.
15 lbs. nitrate soda, equal to full ration.

GROUP 3—SULPHATE OF AMMONIA.

Experiment No. 11—Mixed minerals.

" " 12 { Mixed minerals.
3¾ lbs. sulphate of ammonia, equal to ⅓ ration.

" " 13—Nothing.

" " 14 { Mixed minerals.
7½ lbs. sulphate of ammonia, equal to ⅔ ration.

" " 15 { Mixed minerals.
11¼ lbs. sulphate of ammonia, equal to full ration.

GROUP 4—DRIED BLOOD.

Experiment No. 16—Mixed minerals.

" " 17 { Mixed minerals.
7½ lbs. dried blood, equal to ⅓ ration.

" " 18—Nothing.

" " 19 { Mixed minerals.
15 lbs. dried blood, equal to ⅔ ration.

" " 20 { Mixed minerals.
22½ lbs. dried blood, equal to full ration.

GROUP 5 - COTTON SEED MEAL.

Experiment No. 21—Mixed minerals.

" " 22 { Mixed minerals.
12 lbs. cotton seed meal, equal to ⅓ ration.

" " 23—Nothing.

" " 24 { Mixed minerals.
24 lbs. cotton seed meal, equal to ⅔ ration.

" " 25 { Mixed minerals.
36 lbs. cotton seed meal, equal to full ration.

GROUP 6—FISH SCRAP.

Experiment No. 26—Mixed minerals.

" " 27 { Mixed minerals.
10 lbs. dried fish, equal to ⅓ ration.

" " 28—Nothing.

" " 29 { Mixed minerals.
20 lbs. dried fish, equal to ⅔ ration.

" " 30 { Mixed minerals.
30 lbs. dried fish, equal to full ration.

GROUP 7—MIXED NITROGEN.

Experiment No. 31—Mixed minerals.		
" " 32	Mixed minerals. 1⅔ lbs. nitrate soda. 1¼ " sulphate ammonia. 4 " cotton seed meal.	equal to ⅓ ration, mixed nitrogen.
" " 33—Nothing.		
" " 34	Mixed minerals. 3⅓ lbs. nitrate soda. 2½ " sulphate ammonia. 8 " cotton seed meal.	equal to ⅔ ration.
" " 35	Mixed minerals. 5 lbs. nitrate soda. 3¾ " sulphate ammonia. 12 " cotton seed meal.	equal to full ration.

GROUP 8—FORMS OF NITROGEN ALONE.

Experiment No. 36—Fish scrap.
" " 37— " "
" " 38—Nothing.
" " 39—Mixed nitrogen.
" " 40 " "

In the above experiments, such quantities of each form is taken as to represent equal amounts of nitrogen, and these are taken in ⅓, ⅔ and full rations. Our object is to test the best form and quantity of nitrogen for cane, as well as to test the other question of loss of these manures by leaching. This plat was planted March 11.

PHOSPHORIC ACID MANURES—PLAT 7.

The object of this plat is to test the form and quantity of phosphoric acid best adapted to cane; using it in a soluble form in dissolved bone black and acid phosphate, in a precipitated form as precipitated bone black and precipitated acid phosphate, and in an insoluble form as bone dust and finely ground Charleston phosphate, called "floats:" also in the natural form of Orchilla guano. Beside above we have a group of gypsum, or land plaster, to answer how far this substance in every super-phosphate may be responsible for its good results This plat was planted February 20th and 22d.

GROUP 1—DISSOLVED BONE BLACK.

(Phosphoric Acid.)

Experiment No.	1	18 lbs. cotton seed meal. 18 " kainite. Basal mixture.*
" "	2	Basal mixture. 6 lbs. dissolved bone black, equal to $\frac{1}{3}$ ration.
" "	3	—Nothing.
" "	4	Basal mixture. 12 lbs. dissolved bone black, equal to $\frac{2}{3}$ ration.
" "	5	Basal mixture. 18 lbs. dissolved bone black, equal to full ration.

GROUP 2—ACID PHOSPHATE.

(Soluble.)

Experiment No.	6	—Basal mixture.
" "	7	Basal mixture. 6 lbs. acid phosphates, equal to $\frac{1}{3}$ ration.
" "	8	—Nothing.
" "	9	Basal mixture. 12 lbs. acid phosphate, equal to $\frac{2}{3}$ ration.
" "	10	Basal mixture. 18 lbs. acid phosphate, equal to full ration.

GROUP 3—PRECIPITATED BONE BLACK.

(Precipitated Phosphoric Acid.)

Experiment No.	11	--Basal mixture.
" "	12	Basal mixture. 6 lbs. precipitated bone black, equal to $\frac{1}{3}$ ration.
" "	13	—Nothing.
" "	14	Basal mixture. 12 lbs. precipitated bone black, equal to $\frac{2}{3}$ ration.
" "	15	Basal mixture. 18 lbs. precipitated bone black, equal to full ration.

GROUP 4—PRECIPITATED ACID PHOSPHATE.

(Precipitated Phosphoric Acid.)

Experiment No.	16	—Basal mixture.
" "	17	Basal mixture. 6 lbs. precipitated acid phosphate, equal to $\frac{1}{3}$ ration.
" "	18	--Nothing.

*Basal mixture in this group means 18 lbs. cotton seed meal and 18 lbs. kainite.

Experiment No. 19 { Basal mixture. [ration.
12 lbs. precipititated acid phosphate, equal to $\frac{2}{3}$

" " 20 { Basal mixture. [ration.
18 lbs. precipitated acid phosphate, equal to full

GROUP 5—BONE DUST.

(Insoluble Phosphoric Acid.)

Experiment No. 21—Basal mixture.

" " 22 { Basal mixture.
6 lbs. bone dust, equal to $\frac{1}{3}$ ration

" " 23—Nothing.

" " 24 { Basal mixture.
12 lbs. bone dust, equal to $\frac{2}{3}$ ration.

" " 25 { Basal mixture.
18 lbs. bone dust, equal to full ration.

GROUP 6—ROCK PHOSPHATE.

(Insoluble Phosphoric Acid.)

Experiment No. 26—Basal mixture.

" " 27 { Basal mixture.
6 lbs. floats, equal to $\frac{1}{3}$ ration.

" " 28—Nothing.

" " 29 { Basal mixture.
12 lbs. floats, equal to $\frac{2}{3}$ ration.

" " 30 { Basal mixture.
18 lbs floats, equal to full ration.

GROUP 7—NATURAL PHOSPHATE.

Experiment No. 31—Basal mixture.

" " 32 { Basal mixture.
6 lbs. Orchilla guano, equal to $\frac{1}{3}$ ration.

" " 33 Nothing.

" " 34 { Basal mixture.
12 lbs. Orchilla guano, equal to $\frac{2}{3}$ ration.

" " 35 { Basal mixture.
18 lbs. Orchilla guano, equal to full ration.

GROUP 8—GYPSUM.

Experiment No. 36—Basal mixture.

" " 37 { Basal mixture.
3 lbs. gypsum, equal to $\frac{1}{3}$ ration.

" " 38 { Basal mixture.
6 lbs. gypsum, equal to $\frac{2}{3}$ ration.

" " 39 { Basal mixture.
9 lbs. gypsum, equal to full ration.

POTASSIC MANURES—PLAT 8.

This plat is designed to test the form and quantity of potash best adapted to cane, using the muriate, sulphate, nitrate, carbonate and kainite. The ashes of cotton hulls have been used elsewhere in other plats. For potatoes and sugar beets the sulphate is preferred to the muriate, the latter injuring the sugar in beets and the starch in potatoes. This plat was planted March 15.

GROUP 1—FORMS OF POTASH ALONE.

Experiment No. 1— 4 lbs. muriate of potash.
" " 2—16 " kainite.
" " 3—Nothing.
" " 4—4 lbs. sulphate potash.
" " 5—2¾ " carbonate potash.

GROUP 2—MURIATE POTASH.

Experiment No. 6 { 18 lbs. cotton seed meal. 15 " acid phosphate. *Meal phosphate.
" " 7 { Meal phosphate. 4 lbs. muriate potash, equal to ⅓ ration.
" " 8—Nothing.
" " 9 { Meal phosphate. 8 lbs. muriate potash, equal to ⅔ ration.
" " 10 { Meal phosphate. 12 lbs. muriate potash, equal to full ration.

GROUP 3—KAINITE.

Experiment No. 11—Meal phosphate.
" " 12 { Meal phosphate. 16 lbs. kainite, equal to ⅓ ration.
" " 13—Nothing.
" " 14 { Meal phosphate. 32 lbs. kainite, equal to ⅔ ration.
" " 15 { Meal phosphate. 48 lbs. kainite, equal to full ration.

GROUP 4—SULPHATE POTASH.

Experiment No. 16—Meal phosphate.

*Meal phosphate in this plat means 18 lbs. cotton seed meal and 15 lbs. acid phosphate.

Experiment No. 17 { Meal phosphate. / 4 lbs. sulphate potash, equal to ⅓ ration.
" " 18—Nothing.
" " 19 { Meal phosphate. / 8 lbs. sulphate potash, equal to ⅔ ration.
" " 20 { Meal phosphate. / 12 lbs. sulphate potash, equal to full ration.

GROUP 5—CARBONATE POTASH.

Experiment No. 21—Meal phosphate.
" " 22 { Meal phosphate. / 2¾ lbs. carbonate potash, equal to ⅓ ration.
" " 23—Nothing.
" " 24 { Meal phosphate. / 5½ lbs. carbonate potash, equal to ⅔ ration.
" " 25 { Meal phosphate. / 8¼ lbs. carbonate potash, equal to full ration.

GROUP 6—NITRATE POTASH.

Experiment No. 26—Meal phosphate.
" " 27 { 9 lbs. cotton seed meal. / 15 " acid phosphate. / 4½ " nitrate soda, equal to ⅓ ration.
" " 28—Nothing.
" " 29 { 9 lbs. cotton seed meal. / 15 " acid phosphate. / 9 " nitrate soda equal to ⅔ ration.
" " 30 { 9 lbs. cotton seed meal. / 15 " acid phosphate. / 13½ " nitrate soda, equal to full ration.

COMMERCIAL FERTILIZERS—PLAT NO. 9.

Planted March 15th, except No. 13, that on 21st.

Experiment No. 1—15 bushels compost in drill.
" " 2—15 " " broadcast.
" " 3—50 lbs. Sterns' sugar goods.
" " 4—50 " Sterns' ammoniated dissolved bone.
" " 5—50 " Stono guano.
" " 6—50 " Studniczka's sugar goods.
" " 7—50 " Foster's formula.
" " 8—50 " Rogers' sugar and cotton fertilizer.
" " 9—50 " Mapes' potato manure.
" " 10—50 " Mapes' vine and fruit manure.
" " 11—50 " Planters' cane fertilizer.
" " 15—50 " Soluble Pacific guano.
" " 13—50 " Pacific sugar goods.

The above compost was made from 20 bushels cotton seed, 40 bushels stable manure and 250 lbs. acid phosphate, put up in January and cut down and used March 15. The guanos were all donated by the manufacturers or their agents. See page 21.

SANDY LAND EXPERIMENT—PLAT NO. 16.

The following experiments were placed upon sandy land to test the proportions of nitrogen, phosphoric acid and potash adapted to cane on this character of soil. Planted Feb. 19 and 20.

		Proportions of nitrogen to	phos. acid, to	potash
Exp't No. 1	32½ lbs. cotton seed meal. 12½ " kainite. 5 " acid phosphate.	3	1	1½
" " 2	30 " cotton seed meal. 12½ " kainite. 7½ " acid phosphate.	2	1	1
" " 3	25 " cotton seed meal. 12½ " kainite. 12½ " acid phosphate.	1	1	1
4	25 " cotton seed meal. 25 " kainite. 12½ " acid phosphate.	1	1	2
" " 5—Nothing.				
" " 6—Nothing.				
" " 7	18¾ lbs. cotton seed meal. 18¾ " acid phosphate. 12½ " kainite.	1	2	1
" " 8	18¾ " cotton seed meal. 18¾ " acid phosphate. 25 " kainite.	1	2	2
" " 9	18¾ " cotton seed meal. 18¾ " acid phosphate.	1	2	0
" " 10	15 " cotton seed meal. 22½ " acid phosphate. 12½ " kainite.	1	3	1½

STUBBLE CANE.—PLAT NO. 14.

This plat is the only piece of first year stubble on the place. It was used to windrow cane in during the past winter, and has been, perhaps, partially injured, As it was the only opportunity of trying some experiments upon first year stubble, it was deemed expedient to run the risk of the injury. Accordingly it

was off-bared, dug, and manures applied March 18th and 19th, and well harrowed in. The object of the experiment is to test manurial requirements of stubble cane upon sandy land.

Experiment	No.	Quantity	Manure	Nitrogen to	phos. acid.
Experiment	No. 1	32½ lbs.	cotton seed meal.	3	1
		5 "	acid phosphate.		
"	" 2	30 "	cotton seed meal.	2	1
		7½ "	acid phosphate.		
"	" 3	25 "	cotton seed meal.	1	1
		12½ "	acid phosphate.		
"	"	4—Nothing.			
"	" 5	18¾ lbs.	cotton seed meal.	1	2
		18¾ "	acid phosphate.		
		4 "	muriate potash.		
"	" 6	18¾ "	cotton seed meal.	1	2
		18¾ "	acid phosphates.		
"	" 7	15 "	cotton seed meal.	1	3
		22½ "	acid phosphate.		
"	" 8	5 "	nitrate soda.	Formula recommended for cane stubble by Agricultural Station at St. Denis.	
		7 "	sulphate ammonia.		
		6 "	dried blood.		
		28 "	acid phosphate.		
		4 "	muriate potash.		
"	" 9	14 "	nitrate potash.	Formula recommended for stubble cane by Geo. Ville, of France.	
		32½ "	acid phosphate.		
		21½ "	gypsum.		
"	" 10	30 "	tankage.		
"	" 11	30 "	tankage.		
		20 "	ashes cotton seed hulls.		
"	"	12—15 bushels compost, (see page 19,)			
"	"	13—50 lbs.	Sterns' ammoniated dissolved bone.		
"	"	14—50 "	Sterns' sugar goods.		
"	"	15—50 "	Stono guano.		
"	"	16—50 "	Studniczka's cane grower.		
"	"	17—50 "	Rogers' sugar goods.		
"	"	18—50 "	Foster's formula.		
"	"	19—50 "	Mapes' potato manure.		
"	"	20—50 "	Mapes' vine and fruit manure.		
"	"	21—Nothing.			
"	"	22—50 lbs.	Soluble Pacific guano.		
"	"	23—50 "	Planters' cane fertilizer.		

The Pacific sugar goods reached here too late to be put on stubble.

PLAT NO. 15

contains second year stubble. Cane was also windrowed in this, and great apprehension exists as to its safety. However, it has

been plowed and dug, and should a stand prevail it will be suitably manured at proper time.

These are the experiments a'ready instituted in cane at the Station—a much larger number than was at first expected. But so little is known of the manurial requirements of cane that it was deemed best to investigate it in every possible direction. After this year it is hoped the number of experiments can be materially reduced. The Station has had already many unlooked for difficulties to contend with. A portion of its land is very black and stiff, and the proper preparation of such a soil for cane has required more time, patience and heavy labor than was anticipated. This has been largely due to the deficiency of drainage and bad culture which had previously prevailed here. Again, the winter has been unusually severe and long, and therefore the fall planted cane has been seriously retarded and somewhat injured. The seed cane used by the Station for spring planting was purchased in windrows, and put up before the occupation of this place by the Station. Much of it was removed in September from the front lands to make way for the new levee then just begun. It was left several days out of the ground, causing dry rot, and then windrowed in a corn field with no attention to drainage, causing wet rot. Accordingly, when the windrows were opened this spring, a large amount was totally rejected, another had to be carefully assorted, and another part, the best, was planted without assortment. Had the spring been propitious, no doubt would be entertained of an excellent stand, so great was the amount used in planting; but the unusually cold, wet and backward spring has caused much of it to rot since planting, hence a serious apprehension for a stand on some plats. However, provision has been made to partially repair a want of a stand by an extensive hot bed, and the procurement, through the liberality of Mr. Leon Godchaux, of a car load of good seed cane, with which we hope to fill up vacancies.

Early in August, the Station will begin the analyses of samples of cane from each plat and continue them up to the grinding season. By this means it is expected to learn much of the development of sugar in cane, the fertilizers which will hasten this process, and the effects of the various kinds of manures upon the sugar cane. At the end of the season each experiment will be carefully weighed and analyzed, its products, as far as practicable, followed into the sugar house with careful analyses. Such are the present purposes of the Station.

EXPERIMENTS IN SORGUM.

It has been suggested that if a large variety of sorghum, which would mature in September, could be obtained it would be a valuable acquisition to the sugar planter by enabling him to run his sugar mill during September and October, thus prolonging his season of grinding. Be this as it may, the Station, with a view of determining the adaptability of the various sorghums to this purpose, has planted the following varieties:

No. 1—Honduras.
" 2—Link's hybrid.
" 3—Chinese sorghum.
" 4—India sorghum.
" 5—Stewart's hybrid.
" 6—White seeded sorghum.
" 7—Early orange.
" 8—Early amber.

These will be carefully watched and analyzed at maturity, seed saved and replanted with the hope of finally securing an acclimated variety, rich in sugar, adapted to the supposed wants of the sugar planter.

SUGAR BEETS.

A package of white imperial sugar beet seed received by Mr. Lucien Soniat from the Agricultural Department at Washington, was kindly divided with the Station. Two rows of these beets are now growing, which will furnish the Station with samples for testing their sugar content at the end of the season. The seed used are said to be from the south of France.

CORN EXPERIMENTS.

Two plats are devoted to corn—one of about 2 acres, to varieties; the other, of 12 acres, to manurial requirements of corn.

PLAT NO. 10—VARIETIES OF CORN.

No. 1—Yellow flint, grown on tile drained land.
" 2— " " " from Western seed.
" 3—Mexican flint, grown from seed obtained at Exposition of '85.
" 4—Creole corn.
" 5—Cross between Mexican and Creole corn.
" 6—White Mexican, from seed obtained at Exposition of '85.
" 7—Corn from Kentucky seed.

The first six varieties were grown on the Alice C. plantation, and were presented by Mr. D. R. Calder; the 7th was raised on the Tchoupitoulas plantation, and was presented by Mr. Lucien Soniat, together with some Creole corn used on Plat 17.

FERTILIZERS FOR CORN—PLAT NO. 17.

The object of this plat is to determine the manurial requirements of corn.

Experiment No. 1—22½ bushels compost.
" " 2—60 lbs. Pacific sugar goods.
" " 3—60 " Soluble Pacific guano.
" " 4—60 " Rogers' sugar and cotton fertilizer.
" " 5—60 " Studiczka's sugar goods.
" " 6—60 " Stono guano.
" " 7—Nothing.
" " 8—60 lbs. Sterns' ammoniated dissolved bone.
" " 9—60 " Sterns' sugar goods.
" " 10—60 " Foster's formula.
" " 11—60 " acid phosphate.
" " 12—Nothing.
" " 13—60 lbs. tankage.
" " 14 { 60 " tankage. / 20 " ashes cotton hulls.
" " 15—Nitrate soda.
" " 16—Sulphate ammonia.
" " 17—Nothing.
" " 18—Dried blood.
" " 19—Cotton seed meal
" " 20—Mixed minerals.

NITRATE SODA GROUP.

" " 21 { Mixed minerals. / Nitrate soda, equal to ⅓ ration.

NITRATE SODA GROUP—CONTINUED.

Experiment No. 22—Nothing.

" " 23 { Mixed minerals. Nitrate soda, equal to ⅔ ration.

" " 24 { Mixed minerals. Nitrate soda, equal to full ration.

SULPHATE AMMONIA GROUP.

Experiment No. 25—Mixed minerals.

" " 26 { Mixed minerals. Sulphate ammonia, equal to ⅓ ration.

" " 27—Nothing.

" " 28 { Mixed minerals. Sulphate ammonia, equal to ⅔ ration.

" " 29 { Mixed minerals. Sulphate ammonia, equal to full ration.

DRIED BLOOD GROUP.

Experiment No. 30—Mixed minerals.

" " 31 { Mixed minerals. Dried blood, equal to ⅓ ration.

" " 32—Nothing.

" " 33 { Mixed minerals. Dried blood, equal to ⅔ ration.

" " 34 { Mixed minerals. Dried blood, equal to full ration.

Experiment No. 35—Mixed minerals.

" " 36 { Mixed minerals. Cotton seed meal, equal to ⅓ ration.

" " 37—Nothing.

" " 38 { Mixed minerals. Cotton seed meal, equal to ⅔ ration.

" " 39 { Mixed minerals. Cotton seed meal, equal to full ration.

" " 40 { 80 lbs. Orchilla guano. 80 " cotton seed meal.

" " 41—Nothing.

" " 42—80 lbs. Orchilla guano.

" " 43 { 80 " floats. 80 " cotton seed meal.

" " 44—Nothing.
" " 45—80 lbs. floats.
" " 46—80 " acid phosphate.
" " 47—20 " muriate potash.
" " 48—Nothing.
" " 49—80 lbs. cotton seed meal.

Experiment No.50 { 20 " muriate potash.
80 " acid phosphate.

" " 51 { 60 " cotton seed meal.
60 " acid phosphate.

" " 52 { 60 " cotton seed meal.
15 " muriate potash.

" " 53 { 60 " cotton seed meal.
60 " acid phosphate.
15 " muriate potash.

" " 54 { 60 " tankage.
15 " gypsum.

" " 55 { 60 " tankage.
15 " muriate potash.

" " 56--Nothing.

RICE EXPERIMENTS.

The Station not being prepared to grow rice, and yet desirous of determining the effects of different fertilizers upon this cereal, accepted the proffer of Mr. H. S. Wilkinson, whose rice farm adjoins the Station, to whatever land that might be needed. Accordingly, with the co-operation of Mr. Wilkinson, the following experiments have been planted:

Experiment No. 1 { 50 lbs. cotton seed meal.
25 " acid phosphate.
10 " muriate potash.

" " 2 { 50 " cotton seed meal.
25 " acid phosphate.

" " 3—Nothing.

" " 4—50 lbs. cotton seed meal.

" " 5 { 25 " acid phosphate.
10 " muriate potash.

" " 6—25 " acid phosphate.
" " 7—10 " muriate potash.
" " 8--Nothing.

" " 9 { 8 lbs. nitrate soda.
5 " sulphate ammonia.
10 " dried blood.
25 " acid phosphate.
10 " muriate potash.

" " 10 { 50 " tankage.
10 " muriate potash.

" " 11—50 " tankage.

" " 12 { 25 " Orchilla guano.
10 " muriate potash.

" " 13—Nothing.

Experiment No. 14—25 lbs. Orchilla guano.
" " 15—25 " floats.
" " 16—25 " Pacific sugar goods.
" " 17—25 " Foster's formula.
" " 18--Nothing.
" " 19—25 lbs. Studniczka's sugar goods.
" " 20—25 " Sterns' sugar goods.

This is the first time, as far as the Station is informed, that fertilizers of any kind have ever been used under rice. It is to be hoped that they will prove beneficial and be of value to many of our planters.

The Station wishes to acknowledge its indebtedness to the following:

Messrs. John T. Moore, Jr., & Co., New Orleans, for fertilizers.
Sterns' Fertilizing Company " "
A. Y. Rodgers & Co. " "
Henry Studniczka " "
Planters' Fertilizing Company " "
Mapes' Fertilizing Company, New York, "
Travers, Snead & Co., Richmond, Va., Orchilla guano.
Eliwan Phosphate Company, Charleston, S. C., acid phosphate and floats.
D. R. Calder, New Orleans, seed corn.
Lucien Soniat, Jefferson parish, seed corn and sugar beet seed.
Leon Godchaux, New Orleans, one car load seed cane.
Mississippi Valley Railroad, for favors.
Police Jury of Jefferson parish, for repairing road.

APPENDIX.

LOUISIANA SUGAR EXPERIMENT STATION.

RECORD OF WEATHER FOR MARCH.

—Kenner, La.—

DATE.	TEMPERATURE. 9 A. M.	3 P. M.	9 P. M.	Max.	Min.	Daily rain fall.	State of weather
March 2	....	....	....	....	49°	....	Cloudy.
" 3	....	....	....	....	47	.75	"
" 4	....	....	....	....	49	1.50	"
" 5	....	....	....	....	49	.20	"
" 6	....	....	....	....	50	.00	Fair.
" 7	51°	57°	54°	....	49	.00	Cloudy.
" 8	55	52	60	....	50	.00	"
" 9	62	....	....	....	50	.13	"
" 10	42	49	42	....	39	.00	Clear.
" 11	50	59	55	....	37	.00	Cloudy.
" 12	62	60	60	....	59	.28	Rainy.
" 13	49	57	48	....	47	.00	Clear.
" 14	57	60	54	....	37	.00	Fair.
" 15	63	70	59	....	49	.06	Clear.
" 16	61	63	60	....	57	.80	Rainy.
" 17	61	72	61	....	59	.00	Clear.
" 18	61	64	62	....	55	.00	Cloudy.
" 19	65	72	61	....	62	.97	Clear.
" 20	64	70	64	....	63	.05	Cloudy.
" 21	52	64	52	....	47	.00	Clear.
" 22	57	64	52	....	47	.00	"
" 23	57	63	61	....	47	.00	"
" 24	60	69	56	71°	50	.00	"
" 25	68	72	62	76	52	.00	Fair.
" 26	64	72	64	78	56	.22	"
" 27	62	77	67	80	62	.30	Cloudy.
" 28	73	67	70	80	64	.10	Rainy.
" 29	70	72	70	78	69	.00	Cloudy.
" 30	57	54	49	72	57	3.75	Rainy.
" 31	40	57	52	58	47		Clear.
						9.13	

Highest temperature, 80°—Lowest temperature, 37°.

J. D. STUBBS, Observer.

BULLETIN

No. 4.

SUGAR EXPERIMENT STATION,

KENNER, LA.,

—AND—

State Experiment Station,

BATON ROUGE, LA.

WM. C. STUBBS, A. M. PH. D.,

DIRECTOR.

—ISSUED BY—

THOMPSON J. BIRD,

COMMISSIONER OF AGRICULTURE,

BATON ROUGE, LA.

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1886.

BATON ROUGE, LA., July 8th, 1886.

Maj. T. J. Bird, Commissioner of Agriculture, Baton Rouge:

I hand you herewith for publication, a bulletin on oats, covering results of experimets at the Sugar Experiment Station, Kenner, La., and the State Experiment Station. Baton Rouge, La., for the past season.

Respectfully,

WM. C. STUBBS,
Director.

OATS

is the third cereal in importance in the United States, the total acreage in 1879 being 16,144,593 acres, yielding 407,858,999 bushels. Louisiana in the same year had 26,861 acres, with a total yield of 229,840 bushels. Over most of the United States it is a spring crop, and is harvested in July. At the South the winter varieties exist, and but for the depredation of the rust would long ago have become extensively raised. In late years, however, reliable rust-proof varieties have been obtained; but these varieties are afflicted with another serious defect which prevents their extensive use as a winter oat, viz., liability to be killed by cold. This is shown by our experiments given further on.

HISTORY OF OATS.

No record is made of oats in the Holy Scriptures. Some geologists assert that it made its appearance in the Bronze Age, long after wheat and barley. The pre-historic nations of Central Europe cultivated it, and occasionally grains of this cereal have been found in the remains of the "later dwellers" of Switzerland. Its cultivation increased with civilization in Northern and Central Europe, until it has become the chief bread product in Scotland and adjoining isles. It was brought to America from Europe, and to-day it is cultivated in every State and Territory.

NATURAL HISTORY OF OATS.

It belongs botanically to the genus "Avena," and there are several species. Of the latter, three are well defined. Two with adherent husks, viz: our common varieties "Avena Saliva," and those with heads only on one side of stem, "Avena Orientales," usually known as the Oriental oats. There is a third species in which the husk separates from the kernel, leaving a naked seed, like wheat; they are commonly called "naked" or "skinless" oats, botanically "Avena Nuda."

SOILS ADAPTED TO OATS.

All kinds, from heaviest clays to the lightest sands, will grow oats. They thrive best upon rich soils, with abundant but not excessive moisture. Hence upon well drained bottom lands, in our climate we find the largest and heaviest crops. They vary in weight per bushel from 20 to 50 pounds. The legal weight per bushel is generally 32 pounds.

CULTIVATION OF OATS.

After a thorough preparation of the soil, the oats are generally sown broadcast, harrowed and rolled in. Sometimes they are lightly plowed in ; they are harvested with sickle, scythe, cradle and reaper, sometimes bound in sheaves and sometimes treated as hay.

OATS AS FOOD.

We have mentioned the extensive use of oatmeal for human food in Scotland, Scandinavia and Iceland. It is also used to a limited extent as such in this country.

But its chief use is as a food for horses and mules, for which it is specially adapted. Turfmen, early recognizing this fact, have fed their fastest horses exclusively on oats. For heavy work in a hot climate, it surpasses all other grains as a food for stock. The unhulled oats approach nearer the perfect ration for a horse than any other grain. Experiments carefully conducted at several German experiment stations, have also shown that oats cut just before maturity, when the seed are in the dough and the stalk slightly yellow, and fed in the sheaf, (best done by cutting up into small pieces with a good cutting machine) constitutes the perfect ration for the work-horse, and no other food of any kind is needed.

Even the straw of oats is preferred for cattle feed to that from wheat and rye, while the latter are usually preferred by the paper mills.

MANURES FOR OATS.

It has been long known that oats, like other cereals, responded best to large doses of nitrogenous manures, and therefore was classed among those plants which require manures, whose dominant ingredient was nitrogen. A series of experiments, how-

ever, conducted by Messrs. Lawes & Gilbert upon this plant have shown that while nitrogenous manures alone largely increased the crop, the addition of acid phosphate and potassic salts to the nitrogenous manures still further enhanced the yield. Hence while it is claimed that available nitrogen is most needed in a manure for oats, still it is recognized also that fair quantities of phosphoric acid and potash in available forms must be present either in the manure or in the soil, in order to produce maximum results. In our experiments we have tried to test the manurial acquirements of our soils for growing oats.

Before giving our experiments we will here briefly summarize what we have at some length explained in bulletin No 2.

Commercial fertilizers are valuable for only their ingredients, viz: nitrogen, phosphoric acid and potash. They may contain all three of these ingredients, two or one. Kainite is a crude salt of potash and contains about twelve per cent of this ingredient. Acid phosphate contains phosphoric acid, usually from twelve to sixteen per cent. Both nitrate of soda and sulphate of ammonia are valuable only for nitrogen, the former containing fifteen per cent, and the latter 21 per cent of this element. Cotton seed meal is valuable chiefly for its nitrogen, of which it contains about seven per cent, but it contains also small quantities of phosphoric acid (three per cent), and of pot- (two per cent). Muriate of potash contains about fifty per cent of potash.

The ordinary cotton fertilizers sold in our markets are complete manures, and contain usually nitrogen (two to three per cent), phosphoric acid (eight to twelve per cent), and potash (one to three per cent).

EXPERIMENTS AT LOUISIANA SUGAR EXPERIMENT STATION IN OATS, 1886.

The object of these experiments, as well as those upon the State Experiment Station, was primarily to test the economy of growing oats at home as a food crop for stock, in preference to the prevailing custom of importing annually large quantities at great cost. With this end in view we have striven to decide two questions, viz: 1st. Best time to sow? 2d. Manurial requirements of our soils for growing oats? A third question might have been propounded, viz: Which is the best seed? But the experience of southern cultivators has been so unanimous in favor of the rust proof varieties, that this question was eliminated this year. Perhaps hereafter it will be worthy of trial.

To decide

THE BEST TIME TO PLANT.

a series of experiments, covering planting in every month from October to March, was proposed; accordingly plats were planted

October 27th, November 17th, January 30th and February 2d. Pressure of other business prevented planting in December, and the cold and wet weather prohibited an earlier planting in January. The intense cold of January 8th to 13th killed completely the oats sown in November, while those sown in October were unhurt—a valuable suggestion to those intending hereafter to make fall planting. Those sown in October had attained a greater root development than those sown in November, and hence were enabled to withstand a greater severity of cold.

MANURIAL REQUIREMENTS.

To test this question, cotton seed meal, acid phosphate and Kainite were used respectively to furnish nitrogen, phosphoric acid and potash. These substances were used in different quantities and combinations, which will be fully explained under each plat.

The cotton seed meal used contained seven per cent. nitrogen, three per cent. phosphoric acid and two per cent. potash. The acid phosphate had fifteen per cent. of available phosphoric acid; there was twelve per cent. of potash in the Kainite.

PLAT NO. 1.

Object. To test the proportions of cotton seed meal to acid phosphate, best adapted to oats, and incidentally the need of potash to the soil, which was alluvial in character, consisting of a mixture of sandy and black land, the latter predominating; badly drained and in poor tilth. The plat was about two arpents from the front levee, and was about one arpent in depth. Culture of the previous year, old stubble (bad stand) filled in with corn.

PREPARATION OF SOIL.

Land broken with two-horse plow, Oct. 23d; harrowed on 26th; manures distributed broadcast, and red rust-proof (Texas) seed sown at rate of two and a half bushels per acre; both lightly plowed in with one horse-plows, Oct. 27th. This, on account of prevailing drouth was preferred to harrowing in, the usual course adopted in covering oats. The land was left flat with the exception of water drains between the plats.

Nos. 1, 3, and 5., upon the east side, and No. 12 upon the west side, were injured by water standing upon them during the con-

tinuous rains of March. As soon as discovered, open drains for relief were constituted; but these plats never fully recovered from this temporary injury.

The oats came up quickly and gave an excellent stand. The cold of January, which killed other plats, injured this one very little beyond turning the bottom leaves yellow, and this damage was quickly repaired by a few days of subsequent sunshine.

This plat was cut May 20th and 21st, with a cradle, seed in dough state, stalks just turning yellow; cured and weighed on the 22d.

The present prices in New Orleans are for cotton seed meal, $18 per ton; acid phosphate, fifteen per cent., $18 per ton; kainite, twelve per cent., $15 per ton.

The results are appended:

PLAT No. 12—OATS.

Sugar Experiment Station, Kenner, Louisiana.

No. of Experiment	FERTILIZERS.			YIELD PER ACRE.	
	Kind.	Amount Per Acre. Pounds.	Cost Per Acre.	Weight of Oats in Sheaf. Pounds.	Bushels of Oats.
1*	Cotton Seed Meal, Acid Phosphate,	270 270	$ 4 86	6137	67 3-4
2	Cotton Seed Meal, Acid Phosphate, Kainite,	270 270 270	6 80	6673	73 21-32
3*	Cotton Seed Meal, Acid Phosphate,	360 180	4 86	5564	64 17-32
4	Cotton Seed Meal, Acid Phosphate, Kainite,	360 180 270	6 80	6127	67 20-32
5*	Cotton Seed Meal, Acid Phosphate,	405 135	4 86	4991	55 3-32
6	Cotton Seed Meal, Acid Phosphate, Kainite,	405 135 270	6 80	5409	62 28-32
7	Cotton Seed Meal...	300	2 70	6095	59 20-32
8	Acid Phosphate.....	150	1 35	5405	57 30-32
9	Kainite............	150	1 12	5014	51 6-32
10	Nothing............	....	....	5041	51
11	Cotton Seed Meal, Acid Phosphate,	300 150	4 05	8135	103 6-32
12*	Cotton Seed Meal, Acid Phosphate, Kainite,	300 150 150	5 17	5837	70 4-32

*Damaged by water standing on plats.

As before remarked, the defective drainage of a portion of this plat prevents accurate comparisons and deductions. Nos.

1, 3 and 5, occupying the eastern length of the plat, had a slight declivity running entirely through each experiment, which after the continuous rains of March held water several days before discovery. Again there were also found slight depressions in Nos. 5 and 12, which greatly injured these experiments. The rest of the field appeared to be well drained, especially Nos. 7, 8, 9, 10 and 11. These can be compared with each other, but it is manifestly wrong to compare them with rest of field. Omitting the others and taking these we have the following:

	Pounds of Sheaved Oats.	Bushels of Oats.
Nothing	5,041	51
Kainite	5,014	51 6-32
Acid Phosphate	5,405	57 30-32
Cotton Seed Meal	6,095	59 20-32
Cotton Seed Meal, Acid Phosphate,	8,135	103 6-32

From above we find that Kainite alone has given no increase. Acid Phosphate is accountable for 364 pounds sheaved oats, nearly 7 bushels of grain. Cotton seed meal increases the yield of sheaved oats 1,054 pounds and the grain 8⅝ bushels, while acid phosphate and cotton seed meal combined have given the enormous yield of 8,135 pounds (over 4 tons) of sheaved oats and 103 bushels of grain.

PLAT NO. 3.

This plat was thoroughly broken with a four-horse plow, Nov. 15th; harrowed, and manures and seed, (red rust-proof, at the rate of two and a half bushels per acre), distributed broadcast and lightly plowed in with a one-horse plow, November 17th. A perfect stand was thus early secured, which grew off well and was looking remarkably fine, when it was completely destroyed by the freeze of January 8th to 13th. On February 1st and 2d, it was again seeded with the same variety of oats at the rate of two bushels per acre, and again plowed in lightly with one-horse plows.

Stand good; but the growth was never rapid, nor effects of manures very apparent.

The soil of this plat which lies north of No. 12, is very black and stiff, and is still suffering from defective drainage. It was four acres deep by nearly one-half acre wide, and increased in

stiffness with depth. Therefore only those experiments occupying the same width can be compared, or to speak more plainly, the plat was four experiments deep by three wide, with the nothing experiments running entirely through the middle. The plat was accordingly divided into groups. This plat was cut with cradle June 1st; dried and weighed with following results:

PLAT NO. 3—OATS.

Louisiana Sugar Experiment Station, Kenner, La.

No. of Experiment	FERTILIZERS. Kind.	Amount Per Acre. Pounds.	Cost Per Acre.	YIELD PER ACRE. Weight of Oats in Sheaf. Pounds.	
1	Cotton Seed Meal...	480	$ 4 32	5658	Group I.
2	Nothing...........	....	....	....	
3	Cotton Seed Meal, Acid Phosphate	480 96	5 18	Mixed in drying and separate weights not obtained.	
4	Acid Phosphate, Kainite,	96 192	2 30	2594	Group II.
5	Nothing..........	....	....	2834	
6	Cotton Seed Meal, Kainite,	480 192	5 76	4890	
7	Acid Phosphate.....	96	86	3295	Group III.
8	Nothing...........	....	....	2353	
9	Kainite............	192	1 44	2305	
10	Cotton Seed Meal, Acid Phosphate; Kainite,	480 96 192	6 62	2833	Group IV,
11	Nothing...........	....	....	2449	
12	Cotton Seed Meal, Floats, Kainite	480 96 192	6 62	3170	

No conclusions of value can be drawn from these experiments except the efficacy of cotton seed meal as a manure for oats upon these soils. Whether this would have been improved by the addition of acid phosphate in No. 3, is still unknown, since the careless ignorance of a negro, when drying it for weighing, mixed it with No. 2, and thus vitiated the results of both plats. One apparent feature of this plat attracts attention and calls for study, viz.: The experiments on the eastern side of the plat Nos. 1, 6, 7 and 12, were uniformly better than those on the western, and that too in seeming disregard of manures, coupon Nos. 4 and 7, 10 and 12.

PLAT No. 13.

Was broken with a two-horse plow, harrowed; fertilizers and

oats sown broadcast and plowed in with one-horse plow on January 30, 1886. Two bushels of seed (Texas red rust proof) were used per acre.

OBJECT.

The object of these experiments was to test the value of ingredients used first on oats and then following with cow peas, to find what effect the residues of manures left in the soil would have on the latter. The late Dr. Ravenel, of Charleston, S. C., used a mixture of South Carolina floats (finely ground rock phosphate) mixed with kainite as a specific manure for cow peas. By its use an increased growth of peas was attained, which, turned under at the proper time, or permitted to rot on the surface, gave an enhanced fertility to the soil. Using these ingredients as sources of phosphoric acid and potash, alone and combined with cotton seed meal, and in another series substituting orchilla phosphate (a natural deposit from Caribbean Sea) for floats, we have tried to determine the effects upon plats. Since the removal of the oats, the land has been sown in cow peas, and the effects upon the latter will also be noted. Another experiment in this plat which received no manure when planted was top dressed with nitrate of soda (fifteen per cent nitrogen) late in April, while an adjoining plat was left permanently unmanured.

This plat was cut with a cradle on June 2d, thoroughly dried and weighed.

The results are appended :

PLAT No. 13—OATS.

Louisiana Sugar Experiment Station, Kenner, La.

No. of Experiment.	FERTILIZERS.			YIELD PER ACRE.
	KIND.	Amount Per Acre. Pounds.	Cost Per Acre.	Weight of Sheaved Oats. Pounds.
1	Cotton Seed Meal, Orchilla Phosphate, Kainite.	250 250 125	$ 5 34	3860
2	Cotton Seed Meal. S. Carolina Floats, Kainite.	250 250 125	5 34	4776
3	Nitrate Soda..........	200	5 00	3485
4	Nothing...............	....	....	2460
5	Orchilla Phosphate, Kainite.	250 125	3 19	2520
6	S. Carolina Floats, Kainite.	250 125	3 19	2580
7	Orchilla Phosphate...	250	2 25	2700
8	S. Carolina Floats....	250	2 25	2940

An examination of above will show the increased yield of those plats on which nitrogen formed a part of the manures. It will further show that the addition of kainite in Nos. 5 and 6, gave no increase over Nos. 7 and 8, where only phosphates were used.

The conclusions forced upon us from the above experiments upon these soils, and with the season just past, are: 1st. Oats sown in October survived the cold winter, while those subsequently seeded, succumbed. 2d. Fall sown oats paid the largest profit; both where manured and unmanured.

EXPERIMENTS IN OATS AT STATE EXPERIMENT STATION, BATON ROUGE, LA.

This station was not organized till February, 1886, and hence the experiments in oats were all made in the spring.

The soil upon which these experiments were made, is a brown loam of from one to seven feet in depth, underlaid by the sites of the loose formation. It is within the "bluff formation" and about forty to forty-five feet above high water (Hilyard). When

fresh it was regarded as first-class uplands, but its long continued cultivation by improvident methods has so greatly exhausted its "fertility" that to-day it is "styled very poor." Experiments so far conducted, show conclusively that it is readily and cheaply susceptible of improvement, and it is only a question of proper methods and a short time to restore its primitive productiveness.

PLAT NO. 1.—OATS.

This plat was plowed with a two-horse plow, February 13th and 15th. Manures sown broadcast February 17th. Texas rust proof oats at the rate of two bushels to the acre were sown February 18th and harrowed in. They were cut with a cradle, June 18th, when overripe, earlier harvesting being prevented by the prevailing rains of June 6th to 18th, which greatly damaged them. After thorough drying they were weighed on 30th June.

PLAT NO. 1—OATS.

State Experiment Station, Baton Rouge, La.

No. of Experiment	FERTILIZERS.			YIELD PER ACRE.		
	KIND.	Amount per acre.	Cost per acre	Weight of oats in sheaf.	Bushels of oats.	Weight of str'w in lbs.
1	Nothing............	....	....	972 lbs.	11 24–32	596
2	Cotton Seed Meal...	300 lbs.	$2.70	2,280 "	27 5–32	1,397
3	Cotton Seed Meal Acid Phosphate	300 " 150 "	4.05	2,700 "	36 29–32	1,519
4*	Cotton Seed Meal Acid Phosphate, Kainite,	300 " 150 " 150 "	5.17	3,000 "	41 5–32	1,688
5	Acid Phosphate, Kainite,	150 " 150 "	2.45	2,820 "	38 5–22	1,599
6	Cotton Seed Meal, Kainite,	350 " 175 "	4.46	2.553 "	30 16–32	1,577

*This plat had an old burrow or headland running entirely across it, which increased the yield.

From these experiments it is difficult to decide which of the above manures has produced most beneficial results—all having responsive yields over the unmanured plat.

PLAT NO. 2.—OATS.

This plat was broken with a two-horse plow on February 16th and seeded with Texas rust-proof oats February 18th, (two

bushels to the acre) using the harrow to put them in. No manure was applied at the time of planting.

On April 8th the manures were applied broadcast as a top dressing to the oats then several inches high.

This plat was caught in the continuous rains of June 6th to 18th, just at maturity and were greatly injured. They were cut with cradle June 18th, overripe, and after thorough drying they were weighed and threshed June 30th, with results as given below.

On April 14th, upon an adjoining unfertilized plat, the words "welcome" and "State Experimental Station" were traced with a small handful of nitrate of soda. Two days afterwards the words were plainly visible in their increased growth and verdancy.

The nitrate of soda used contained fifteen per cent. of nitrogen; the sulphate of ammonia, twenty-one per cent. of nitrogen; the acid phosphate, fifteen per cent. of phosphoric acid; the muriate of potash, fifty per cent. of potash.

PLAT NO. 2.—OATS.

State Experiment Station Baton Rouge, La.

No. of Experiment.	FERTILIZERS.			YIELD PER ACRE.		
	KIND.	Amount per acre.	Cost per acre.	Weight of oats in sheaf.	Bushels of oats	Weight of straw.
1	Nitrate of Soda.....	200 lbs.	$5.00	3,853 lbs.	43 20-32	2,457 lbs.
2	Sulphate of Am'onia	150 "	4.75	3,713 "	42 19-32	2,368 "
3	Nitrate of Soda, Acid Phosphate,	200 " 200 "	6.80	4,213 "	42 25-32	2,844 "
4	Nothing............	....	....	863 "	14 19-32	492 "
5	Sulphate Am'onia Acid Phosphate,	150 " 200 "	6.55	3,638 "	41 6-32	2,320 "
6	Nitrate of Soda, Acid Phosphate, Muriate Potash,	200 " 200 " 100 "	7.55	4,648 "	49 26-32	3,044 "
7	Sulphate Am'onia, Acid Phosphate, Muriate Potash,	150 " 200 " 100 "	7.30	4,645 "	48 15-32	3,194 "

The above clearly shows that the primary want of this soil is Nitrogen, with probably small quantities of both phosphoric acid and potash.

Results of above experiments show that proportion of grain to straw in the oats is very variable. The lowest proportion of

grain was found in Plat No. 2, Experiment 7, thirty-one and twenty-five one hundred per cent of the weight of sheaved oats, and the highest was in Plat No. 1, Experiments 3 and 4, and Plat No. 2, Experiment 4, when it reached forty three and seventy-five one hundredths per cent.

At the sugar station the highest and lowest percentages were forty-five and thirty-five per cent, the latter from fall and the former from spring planting. The weight per bushel of grain was however reversed, the fall outweighing the spring planting in the proportion of seven to six. The highest weight in the fall planting per bushel being thirty-three pounds; the lowest thirty-one pounds; while the highest in spring planting was twenty-eight pounds to bushel, and lowest twenty-four pounds.

CONCLUSIONS.

From the results given above we infer that the planters of Louisiana can easily and cheaply make their own stock feed. Sow Texas rust proof variety (two to two and one-half bushels per acre) early in October, upon well prepared and drained soil, using as a manure a mixture of cotton seed meal and acid phosphate (two of former to one of latter) at rates of four hundred to five hundred pounds per acre, spread broadcast at time of planting, and cover both well. Should there be a tendency to boot too early in winter, graze down in dry weather with stock. Cut just before maturity. In feeding to stock it is economical to cut up the sheaved oats with a good cutting machine.

WEATHER RECORD OF LOUISIANA SUGAR EXPERIMENT STATION KENNER, LA., FOR MONTH OF APRIL, 1886.

Date.	TEMPERATURE.					Comparison of		Total Daily Rainfall, in inches.	State of Weath'r	REMARKS.
April.	9 A. M.	3 P. M.	9 P. M.	Maximum	Minimum.	Wet Bulb.	Dry Bulb.			
1	65°	74°	68°	76°	46°	63°	66°	....	Clear...	
2	70°	72°	61°	74°	57°	67°	70°	....	Clear...	
3	64°	71°	67°	76°	57°	64°	65°	....	Fair ...	
4	65°	66°	65°	68°	62°	66°	66°	2.75	Rainy..	
5	44°	49°	45°	65°	44°	44°	45°	....	Fair ...	
6	52°	56°	49°	57°	41°	49°	52°	....	Fair ...	
7	59°	64°	63°	66°	42°	56°	60°	....	Fair ...	
8	63°	66°	50°	70°	42°	60°	63°	....	Fair ...	
9	64°	70°	61°	71°	48°	62°	64°	....	Fair ...	
10	58°	63°	61°	63°	55°	58°	58°	1.10	Rainy..	
11	65°	74°	64°	74°	54°	65°	66°	....	Fair ...	
12	70°	74°	64°	74°	62°	72°	74°	....	Fair ...	
13	70°	74°	67°	77°	57°	72°	74°	....	Fair ...	
14	68°	72°	65°	72°	63°	68°	68°	....	Cloudy.	
15	70°	74°	69°	74°	61°	69°	71°	.05	Cloudy.	
16	74°	74°	65°	75°	62°	72°	74°	.02	Fair ...	
17	62°	74°	60°	74°	59°	72°	74°	.10	Fair ...	
18	64°	69°	65°	80°	61°	63°	64°	....	Fair ...	
19	71°	74°	68°	75°	61°	71°	72°	....	Fair ...	
20	73°	77°	67°	80°	60°	71°	72°	....	Clear ..	
21	74°	84°	69°	84°	59°	73°	74°	....	Clear ..	
22	74°	86°	70°	86°	69°	83°	84°	....	Clear ..	
23	73°	86°	68°	86°	58°	72°	73°	....	Clear ..	
24	72°	74°	66°	83°	59°	72°	73°	....	Fair ...	
25	79°	79°	72°	83°	61°	79°	80°	....	Fair ...	
26	76°	80°	32°	82°	67°	76°	71°	....	Fair ...	
27	70°	74°	64°	76°	65°	71°	71°	3.30	Rainy..	Heavy wind at 7:30 P. M.
28	97°	79°	68°	82°	62°	77°	77°	....	Clear ..	
29	77°	84°	71°	84°	61°	71°	77°	....	Clear ..	
30	73°	79°	63°	87°	62°	73°	73°	....	Clear ..	
								7.32		

WEATHER RECORD OF LOUISIANA SUGAR EXPERIMENT STATION, KENNER, LA., FOR MONTH OF MAY 1886.

Date	TEMPERATURE.					Comparison of		Total Daily Rainfall, in inches.	State of Weath'r	REMARKS.
May.	9 A. M.	3 P. M.	9 P. M.	Maximum	Minimum.	Wet Bulb.	Dry Bulb.			
1	69°	70°	68°	74°	59°	65°	69°	....	Clear...	
2	65°	76°	64°	76°	60°	61°	65°	....	Fair....	
3	74°	74°	65°	80°	57°	71°	74°	....	Fair....	
4	75°	80°	69°	83°	61°	71°	75°	....	Fair....	
5	78°	82*	72°	87°	61°	75°	78°	....	Fair....	
6	78°	82°	74°	87°	62°	75°	78°	....	Fair....	
7	78°	80°	74°	81°	70°	75°	78°	....	Cloudy.	Inappreciable rainfall.
8	78°	82°	73°	86°	65°	75°	78°	....	Clear ..	
9	79°	82°	72°	87°	61°	69°	72°	....	Clear...	
10	78°	82°	73°	86°	62°	75°	78°	....	Clear...	
11	79°	84°	75°	89°	62°	76°	79°	....	Clear...	
12	79°	85°	75°	88°	67°	86°	79°	....	Clear...	
13	79°	85°	75°	88°	67°	76°	79°	....	Clear...	
14	81°	85°	75°	89°	67°	78°	81°	....	Clear...	Slight shower at 9 P. M.
15	73°	80°	67°	80°	72°	73°	73°	1.71	Rainy..	Stopped at 1:30 P. M.
16	65°	80°	69°	89°	61°	60°	65°	....	Clear...	
17	70°	80°	67°	80°	63°	65°	70°	....	Cloudy.	
18	60°	70°	63°	70°	58°	69°	60°	1.38	Rainy..	
19	65°	80°	67°	80°	60°	64°	65°	....	Fair....	
20	65°	76°	68°	78°	60°	63°	65°	....	Fair....	
21	75°	83°	70°	88°	68°	73°	75°	....	Fair....	Inappreciable shower at [noon.
22	80°	85°	75°	91°	63°	75°	80°	....	Fair....	
23	82°	86°	76°	91°	70°	81°	82°	....	Fair....	
24	82°	88°	75°	91°	70°	79°	82°	....	Fair....	
25	80°	85°	75°	86°	71°	85°	80°	....	Clear...	
26	82°	85°	75°	93°	67°	79°	82°	....	Fair....	
27	85°	88°	77°	93°	67°	82°	81°	....	Fair....	
28	81°	85°	76°	88°	69°	79°	81°	....	Cloudy.	
29	83°	84°	79°	89°	70°	88°	83°	.25	Cloudy.	
30	78°	89°	80°	93°	70°	84°	87°	.25	Cloudy.	Wind with rain.
31	83°	89°	72°	92°	70°	81°	83°	....	Clear...	Slight rain at 7 P. M. with wind.]
								3.59		

WEATHER RECORD OF LOUISIANA SUGAR EXPERIMENT STATION, KENNER, LA., FOR MONTH OF JUNE, 1886.

Date.	TEMPERATURE.					Comparison of		Daily Rainfall In Inches.	State of Weath'r	REMARKS.
June.	9 A. M.	3 P. M.	9 P. M.	Maximum	Minimum.	Wet Bulb.	Dry Bulb.			
1	84°	89°	79°	93°	70°	81°	84°	.....	Fair....	
2	85°	89°	80°	96°	71°	82°	85°	.....	Fair....	
3	85°	88°	80°	92°	74°	81°	85°	.....	Cloudy.	
4	85°	90°	75°	96°	74°	82°	85°	.05	Cloudy.	
5	85°	89°	75°	95°	73°	81°	85°	.08	Cloudy.	
6	80°	75°	74°	88°	71°	80°	80°	1.15	Rainy..	
7	84°	75°	74°	88°	71°	81°	84°	1.25	Rainy..	
8	83°	75°	74°	88°	69°	81°	83°	.30	Rainy..	
9	....	....	....	....	....	....	....	.50	Rainy..	
10	....	....	....	...	....	....	....	.15	Cloudy.	
11	83°	85°	80°	95°	70°	81°	83°	.42	Cloudy.	
12	84°	87°	85°	89°	74°	82°	84°	1.50	Rainy..	
13	80°	83°	78°	89°	74°	78°	80°	.87	Cloudy.	
14	79°	88°	82°	92°	80°	79°	79°	.37	Rainy..	
15	83°	85°	81°	87°	81°	81°	81°	1.42	Rainy..	
16	85°	85°	84°	85°	84°	82°	85°	.04	Rainy..	
17	78°	86°	86°	85°	75°	76°	78°	.15	Cloudy.	
18	75°	76°	84°	84°	72°	74°	75°	.....	Clear...	
19	78°	89°	77°	95°	77°	75°	78°	.....	Clear...	
20	77°	87°	89°	88°	70°	82°	87°	.....	Clear...	
21	76°	86°	76°	88°	72°	74°	76°	.53	Cloudy.	
22	77°	77°	76°	89°	71°	77°	77°	.56	Rainy..	
23	82°	78°	79°	90°	71°	80°	82°	1.57	Rainy..	
24	77°	89°	83°	92°	70°	76°	77°	.....	Cloudy.	
25	86°	92°	83°	95°	75°	83°	86°	.....	Fair,...	
26	87°	80°	77°	89°	74°	84°	87°	.13	Rainy..	
27	90°	8[illegible]°	77°	94°	75°	86°	90°	.....	Cloudy.	
28	89°	93°	83°	95°	72°	83°	85°	.....	Cloudy.	
29	87°	93°	87°	97°	76°	85°	87°	.08	Rainy..	
30	77°	85°	82°	92°	72°	76°	77°	.38	Cloudy.	
								11.50		

SORGHUM.

BULLETIN No. 5

OF THE

LOUISIANA SUGAR EXPERIMENT STATION

Wm. C. Stubbs, Ph. D.,

—DIRECTOR—

KENNER, LOUISIANA, DECEMBER, 1886.

—ISSUED BY—

THOMPSON J. BIRD,

Commissioner of Agriculture, Baton Rouge, La.

BATON ROUGE:

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SUGAR EXPERIMENT STATION,
KENNER, LA., December 7, 1886.

Major T. J. Bird, Commissioner of Agriculture, Baton Rouge, La.:

I hand you herewith, for publication, a Bulletin on Sorghum, covering field, laboratory and sugar house experiments for the past season.

Respectfully,

WM. C. STUBBS, Director.

SORGHUM.

Sorghum has been used as a forage for stock in this country for many years. As such it is adapted to a wide region, and its cultivation has extended over the entire extent of the United States. In other countries it has been used for the manufacture of spirits, glucose, beer and vinegar. Its seeds have been used as a food for men and beast, and in this country a large part of the profit of growing sorghum consists in the value of its seed as a stock-food. For nearly thirty years syrup has been made from it, and during that time high hopes have been entertained of its power to produce profitably sugar. The attempt to make sugar from sorghum has been made almost exclusively by Americans. In China, where the sorghum has probably been grown for thousands of years, we are told by Dr. S. Wells Williams, Professor of Chinese in Yale College, that there is no evidence that it has ever been used for either syrup or sugar making.

It is curious to read in the earlier publications on sorghum, the contradictory opinions and opposite views so positively asserted by the authors. As to the kind of sugar present; the best varfeties; the period of growth; of maximum sugar content and the exact time to work after cutting, nothing was known definitely until the beginning of the scientific investigations by the National Department of Agriculture in 1878. Since that time this Department has assiduously continued its investigations in sorghum and while we write the Fort Scott experiments in diffusion and corbonatation are being brought to a conclusion by the eminent government chemists. The publications of this department upon sorghum since '78, have been numerous and instructive and to-day every farmer has within his reach valuable and definite information in regard to this plant, the result of patient investigation conducted by trained scientists at government expense.

BOTANICAL RELATIONS OF SORGHUM.

Sorghum is one of those plants, whose origin is utterly unknown. By long cultivatioa, its habits and characteristics have been so changed, that no resemblance can now be found to any wild plant. Formerly the different cultivated varieties of sorghum were regarded as distinct species, but moderm botanists have been gradually led to the conclusion that all our sorghums and jurphees, including broom corn, chicken corn, durra, milo maize, etc., etc., are but varities of a single species—

Sorghum Vulgare. These conclusions have already inspired many seedsmen, farmers and scientists with the belief, that ultimately by selection of seed, proper fertilization and cultivation, a true sugar bearing sorghum may be obtained, which can be profitably grown and worked, instead of the true sugar cane or beet. Differentiation in plants is accomplished by extending the area of cultivation, taking in differences of soil, climate, rain-fall and manures; by careful selection of seed; by cross breeding, etc. In this way varieties are produced. Some plants have greater capacity for variation than others and sorghum is perhaps surpassed only by Indian corn, in its tendency to assume new varieties under changed conditions. Hence we find a large number of varieties of sorghum on our market, differing in every conceivable character, from content of sugar to color of seed. It is therefore of first importance in growing sorghum to select those varieties best adapted to our wants, remembering the modifying factors of soil, climate and manures.

When the Guinea or chicken corn, a true sorghum, now a a troublesome pest. over so large a portion of the South was introduced, the writer has no information, but it appears probable that its advent here was under one of the earlier varieties of sorghum and finding a congenial soil and climate, it has multiplied amazingly without cultivation, and in the meanwhile so degenerated as to lose its true name (sorghum) and receive in its stead local names, expressive of the contempt in which it is held by the owners and tillers of the soil. Perhaps it may be one of the forms of Durra or Chocolate cane, brought over in colonial tones and disseminated over the continent. It may have been crowded out elsewhere and survived only in the South. But our sugar making sorghums have come within the last thirty years from China through France, and since that time we have rapidly multiplied varieties.

SORGHUM IN THE SOUTH.

Many speculations have been indulged in as to the adaptability of sorghum for sugar making in the South, but as far as the writer knows, no systematic attempt has ever heretofore been made. In the North and West the subject has been investigated in the field, laboratory and sugar house. A million of dollars have been spent in the erection of first-class machinery for the manufacture of sugar from this plant. As yet the success has been only partial. Even the diffusion process applied with national aid in Kansas, has failed to convince the world of the adaptability of this plant to sugar making. Early frosts, severe storms, prolonged drouths, and many other disasters. have almost invariably destroyed a large portion of the cane before reaching the mill. It may therefore be asserted with some degree of positiveness, that in the North sorghum will yet remain as a syrup and not a sugar crop.

But how about this tropical plant in the South? It can be

planted from March to July, and harvested according to varieties, from July to November. If, therefore, a variety can be secured which will give a good tonnage and a medium purity coefficient, it can easily be worked up without interruption from frosts, without additional machinery, and without diminution or detriment to the sugar cane crop.

To test the above the station planted the following varieties last spring: Honduras, Link's Hybrid, Chinese, India, Stewart's Hybrid, White Seeded Sorghum, Early Orange and Early Amber.

There were three experiments in each, "a," "b" and "c"; "a" fertilized with an ammoniated acid phosphate, "b" unfertilized, and "c" with an ammoniated acid phosphate mixed with muriate of potash. Good stands were secured of the Honduras, Link's Hybrid, Chinese and India. The rest imperfectly germinated. They were planted April 5th, and given only one working each with hoe and plow. On June 2d our analyses began. The heads were just beginning to seed. The polariscope showed little or no sugar, varying from 0, 3.7 per cent, the latter found in the Chinese. July 5th another examination was made which indicated marked progress towards maturity. July 17th systematic analyses were made of each of the 24 plats, (8 varieties) and repeated July 30th, August 12th, 19th, 26th and September 3rd. The results are appended.

ANALYSIS OF SORGHUM MADE AT LOUISIANA SUGAR EXPERIMENT STATION.

Date of Analysis.	Variety.		Length of Stalk in Feet.	Diameter of Large End of Stalk in Inches.	Weight of Stalk in Pounds.	Per Centage of Extraction.	Degrees Baume.	Specific Gravity.	Total Solids.	Sucrose.	Coefficient of Purity.	Condition of Seed When Cut.
July 17	Honduras,	a	8.12	1.5	3.06	67.4	6.1	1.0403	11.	7.3	66.6	Milk.
" "	"	b	6.44	1.38	.....	.....	5.9	1.0426	10.6	6.4	60.3	"
" "	"	c	6.50	1.25	1.83	67.3	6.8	1.0493	12.2	6.6	54.19	"
July 30	"	a	.....	.....	.....	.....	7.1	1.0519	12.81	.....	.....	"
" "	"	b	.....	.....	.....	.....	6.3	1.0459	11.4	.....	.....	"
" "	"	c	.....	.....	.....	.....	5.7	1.0413	10.3	.....	.....	"
Aug. 12	"	a	7.4	1.25	2.62	57.25	7.6	1.0557	13.70	9.2	67.10	Dough.
" "	"	b	7.9	.88	1.75	57.42	7.1	1.0519	12.81	7.9	61.60	Dough.
" "	"	c	8.2	1.13	2.60	51.92	8.5	1.0626	15.30	11.4	74.50	"
Aug. 19	"	a	7.8	1.12	2.62	71.5	7.1	1.0579	12.81	9.	70.2	Hard.
" "	"	b	7.4	1.12	2.75	71.5	7.5	1.0531	13.23	9.4	71.05	Dough.
" "	"	c	11.6	1.25	4.	70.	8.8	1.0652	15.90	10.5	66.03	"
Aug. 26	"	a	11.15	1.25	3.38	66.66	8.4	1.0621	15.20	10.	65.80	Hard.
" "	"	b	8.20	1.13	2.31	75.	7.2	1.0527	12.99	8.4	64.69	"
" "	"	c	8.30	1.50	4.12	72.73	7.8	1.0559	13.04	9.	69.04	"
Sept. 3	"	a	9.3	1.	2.	68.75	10.5	1.0786	18.94	14.2	74.90	Mature.
" "	"	b	7.6	1.13	2.18	64.23	6.8	1.0499	12.34	6.5	52.60	Dough.
" "	"	c	8.8	1.62	4.50	5.56	8.6	1.0634	15.50	11.9	76.77	Hard.
July 17	Link's,	a	6.41	1.12	1.53	67.60	8.5	1.0626	15.30	10.5	68.53	Dough.
" "	"	b	7.50	1.12	1.53	71.40	7.	1.0570	12.60	10.	79.30	Hard.
" "	"	c	7.00	1.25	1.44	67.40	8.8	1.0652	15.90	12.5	79.20	Mature.
July 30	"	a	.....	.....	.....	.....	10.2	1.0766	18.50	.....	.....	Mature.
" "	"	b	.....	.....	.....	.....	10.	1.0748	18.10	.....	.....	"
" "	"	c	.....	.....	.....	.....	9.7	1.0722	17.50	.....	.....	"
Aug. 12	"	a	5.11	.88	1.50	68.66	10.5	1.0786	18.94	14.00	73.9	"
" "	"	b	6.70	.88	1.12	57.14	10.1	1.0754	18.17	13.20	72.6	"
" "	"	c	6.11	.62	1.12	66.96	10.6	1.0794	19.11	14.40	75.3	"
Aug. 19	"	a	7.1	.88	1.25	68.	10.8	1.0816	19.62	15.80	81.0	"
" "	"	b	8.1	.75	1.20	67.5	10.6	1.0794	19.11	14.	73.2	"
" "	"	c	6.8	.88	1.33	71.4	10.7	1.0802	19.30	15.30	79.	"
Aug 26	"	a	8.3	.75	1.25	75.	9.	1.0667	16.23	11.50	70.8	"
" "	"	b	6.	.75	1.12	66.66	10.	1.0746	18.05	13.60	75.3	Overripe.
" "	"	c	6.7	1.00	1.37	63.64	9.9	1.0738	17.85	14.10	79	Suckered.
Sept. 3	"	a	5.10	.88	1.06	52.65	10.3	1.0770	18.58	14.8	79.6	"
" "	"	b	7.10	1.12	1.62	61.54	8.6	1.0634	15.50	11.2	78.7	Mat red.
" "	"	c	7.20	.88	1.37	63.64	10.	1.4746	18.05	14.2	78.6	"
July 17	Chinese,	a	6.50	.88	.91	.....	9.8	1.0730	17.70	15.00	84.7	Ripe.
" "	"	b	6.88	.88	.87	65.6	9.4	1.0700	17.	15.00	88.	Ripe.
" "	"	c	6.50	1.25	1.25	62.5	10.	1.0741	18.	16.10	89.4	"
July 30	"	a	.....	.....	.....	.....	9.8	......	.....	13.3	.....	"
" "	"	b	.....	.....	.....	.....	9.2	......	.....	13.	.....	Overripe.
" "	"	c	.....	.....	.....	.....	10.6	......	.....	14.5	.....	"
Aug. 12	"	a	4.9	.62	.75	66.66	10.1	1.0754	18.17	14.2	78.1	"
" "	"	b	4.5	1.12	.50	57.14	9.6	1.0714	17.26	12.2	70.6	"
" "	"	c	6.	.62	.70	66.96	9.1	1.0675	16.35	13.	79.5	"
Aug. 19	"	a	6.1	.75	.88	70.00	10.2	1.0762	18.41	14.6	79.3	"
" "	"	b	6.1	.75	1.00	77.8	10.3	1.0770	18.80	14.4	76.6	Suckered.
" "	"	c	6.4	.88	1.00	.....	9.7	1.0722	17.50	13.4	76.6	"
Aug. 26	"	a	6.1	.88	1.00	62.5	10.8	1.0860	19.49	15.2	78.	"
" "	"	b	6.1	.75	1.18	65.72	9.5	1.0706	17.14	12.2	71.2	"
" "	"	c	6.1	.88	1.00	62.50	9.2	1.0685	16.63	12.	72.1	"
Sept. 3	"	a	5.9	.62	.62	.....	9.6	1.0714	16.96	13.	76.6	" badly.
" "	"	b	5.96	.62	.62	61.	10.1	1.0754	18.23	13.4	73.4	" "
" "	"	c	6.1	.75	1.00	62.5	9.	1.0667	16.23	12.	73.8	" "
July 17	India,	a	6.00	1.25	1.82	65.5	7.8	1.0574	14.1	10.6	75.1	Dough.
" "	"	b	6.50	1.50	1.94	69.4	8.	1.0591	14.5	11.	75.8	"
" "	"	c	6.65	.87	1.56	64.	8.6	1.0634	15.5	11.4	73.5	"
July 30	"	a	.....	.....	.....	.....	9.8	......	.....	.....	.....	
" "	"	b	.....	.....	.....	.....	9.7	......	.....	.....	.....	
" "	"	c	.....	.....	.....	.....	7.9	......	.....	.....	.....	
Aug 12	"	a	7.7	1.12	1.9	.....	10.4	1.0778	18.76	14.	74.6	Hard.
" "	"	b	7.7	1.12	1.9	.....	10.3	1.0770	18.59	13.8	74.3	"
" "	"	c	7.6	.88	1.65	.....	10.3	1.0770	18.59	13.9	74.7	"

Date of Analysis.	Variety.		Length of Stalk in Feet.	Diameter of Large End of Stalk in Inches.	Weight of Stalk in Pounds.	Per Centage of Extraction.	Degrees Baume.	Specific Gravity.	Total Solids.	Sucrose.	Coefficient of Purity.	Condition of Seed When Cut.
Aug. 19	India.	a	6.8	1.	1.75	68.6	11.3	1.0851	20.4	16.5	80.8	Mature.
" "	"	b	7.5	1.	1.56	69.2	10.8	1.0806	19.4	16.	82.4	"
" "	"	c	7.1	1.25	2.31	71.	....	......	.....	.....	.....	"
Aug. 26	"	a	6.5	1.	1.88	66.66	11.1	1.0835	20.00	15.6	78.0	"
" "	"	b	7.3	1.	1.68	57.20	10.9	1.0814	19.58	15.5	79.1	"
" "	"	c	6.7	1.12	1.88	57.20	10.4	1.0778	18.76	15.	79.9	"
Sept. 3	"	a	6.	1-12	1.56	70.8	9.4	1.0738	17.97	13.9	77.3	Suckered.
" "	"	b	6.5	1.12	1.37	63.64	10.5	1.0786	18.94	14.6	77.1	"
" "	"	c	7.9	.88	2 12	64.7	10.3	1.0770	18.58	14.2	76.4	"
July 17	Stewart's,	a	5.8	1.00	1.25	65.5	6.1	1.0443	11.	6.	55.5	Milk.
" "	"	b	7.4	1.12	1.40	69.4	7.8	1 0574	14.1	8.2	58.1	"
" "	"	c	7.8	1.12	1.44	64.0	7.3	1.0536	13 2	7.3	55.3	"
July 30	"	a	.....	.....	.....	.....	6.7	......	.....	.....	.....	"
" "	"	b	....	.....	.....	.....	7.1	......	.....	.....	.....	"
" "	"	c	.....	.....	.....	.....	7.9	......	.....	.....	.....	"
Aug. 12	"	a	6.9	1.00	1.75	57.14	9.1	1 0675	16.35	12.00	73.4	Dough.
" "	"	b	7.	.50	1.96	65 09	8.	1.0688	16.72	9.50	56.7	"
" "	"	c	8.7	1.00	1.80	55.55	7.6	1.0543	13.37	9.20	68.8	"
Aug. 19	"	a	7.9	.88	1.06	55.6	9.	1.0667	16.23	10.9	67.1	"
" "	"	b	6.7	.88	1.56	62.9	8.4	1.0621	15.20	11.1	73.03	"
" "	"	c	8.1	1.00	1.88	.....	9.2	1.0683	16.51	11.5	66.3	"
Aug. 26	"	a	8.2	.88	1.62	53.9	9.7	1.0722	17.50	12.6	72.	Hard.
" "	"	b	6.4	.88	1.26	64.1	8.5	1.0725	17.57	11.5	65.4	"
" "	"	c	7.8	.88	1.68	64.3	9.2	1.0683	16.60	12.3	74.1	"
Sept. 3	"	a	8.2	.88	1.31	.....	10.5	1.0786	18.94	14.6	76.5	Mature:
" "	"	b	7.8	1.06	1.42	62.5	9.	1.0667	16.23	11.6	71.4	Hard.
" "	"	c	7.1	.88	1.31	.....	9.1	1.0675	16.41	12 2	74.3	"
July 15	White Seeded	a	5.16	1.25	1.56	64.	8.7	1.0643	15.70	10.1	64 3	"
" "	" "	b	6.75	1.25	1.81	65.	5.8	1.0422	10.5	5.4	51.4	Milk.
" "	" "	c	7.75	1.12	1.60	64 8	6.8	1.0497	12.5	6.4	51 2	"
July 30	" "	a	.....	.....	.....	.....	....	......	.....	.....	.....	"
" "	" "	b	.....	.....	....	.....	5.9	......	.....	.....	.....	"
" "	" "	c	.....	.....	.....	.....	....	......	....	.....	.....	"
Aug. 19	" "	a	.....	.....	.....	.....	....	......	.....	.....	.....	"
" "	" "	b	.....	.....	.....	.....	....	......	.....	.....	.....	"
" "	" "	c	7.	.75	.82	.....	8.	1.0588	14.42	10.	59.8	Dough.
July 17	Orange,	a	4.	.75	.75	62.50	9.	1.0669	16.3	10.	61.3	"
" "	"	b	7.25	1.12	1.50	66.66	8.2	1.0604	14.8	9.	65.6	"
" "	"	c	5.08	1.12	1.10	62.80	8.4	1.0621	15.2	9.4	61.8	"
July 30	"	a	.....	.....	.....	.....	7.6	......	.....	.....	.....	"
" "	"	b	.....	.....	.....	.....	8.9	......	.....	.....	.....	"
" "	"	c	.....	.....	.....	.....	9.5	......	.....	.....	.....	"
Aug. 12	"	a	6.9	.75	1.37	.....	9.2	1.0683	16.60	11.2	67 5	Hard.
" "	"	b	7.3	.87	1.37	63.50	9.7	1.0722	17.51	12.	68.5	"
" "	"	c	7.2	.88	1.25	63.50	9.8	1 07 0	17.68	12.6	71.2	"
Aug 19	"	a	5.12	.75	.94	70.	9.5	1.0706	17.14	13.7	79.9	Ripe.
"	"	b	6.1	.87	1 12	78.7	9.7	1.0722	17.51	13.	74.3	"
" "	"	c	5.5	.87	1.06	73.4	10.1	1.0754	18.17	.....	.....	"
Aug. 26	"	a	6.2	.87	1.06	....	10.5	1.0786	18.98	12.1	63.8	"
" "	"	b	6.4	.75	1.18	66.66	10.	1.0746	18.05	11.5	63.8	"
" "	"	c	5.7	.75	.75	.....	....	......	.....	.....	.....	"
Sept. 3	"	a	4.1	.88	.88	57.20	9.8	1.0730	17.67	13.4	75.8	"
" "	"	b	6.8	1.00	1.12	53.60	10.2	1.0762	18.43	13.5	73.2	"
" "	"	c	6.2	.88	1.06	55.60	10.5	1.0786	18.94	14.	74.4	"
July 17	Amber,	a	5.00	1.00	1.15	67.60	8.	1.0591	14.5	10.4	71.7	Milk.
" "	"	b	5.66	1.12	1.03	63.70	8.2	1.0604	14.8	9.2	65.5	"
" "	"	c	6.00	1.12	1.40	63.70	8.2	1.0604	14.8	9.6	64.8	"

After July 17th, the Guinea corn took such complete possession of this plant (early amber) that it was almost impossible to distinguish the one from the other.

Several analyses of Guinea corn were also made at various dates—giving of total solids 10-13 per cent.—sucrose 4 to 8 per cent.

An inspection of above will show that the *Chinese* was the first to ripen—reaching maturity early in July. After that period it began to throw out suckers at each joint which soon formed heads; so that when cut, Sept. 13th, each stalk had from five to ten heads of ripened seed. This variety though early and rich in sugar, is too small for profitable working into sugar. It produces however, an enormous amount of seed.

Link's Hybrid reached maturity the last of July, remained nearly stationery in this sugar content till cut Sept. 13th. It suckered but very little. It gave stalks of medium size and very fair quality, and romises to be one of best adapted sorghums for sugar at the South.

Honduras is one of the largest sorghums, many of its stalks cutting nine feet for the mill, and weighing four pounds after being stripped and topped. It is a late variety, reaching maturity in September, and has only a moderate sugar content. Under proper manuring and cultivation it may be made an excellent sugar producing variety. There is however, an intensely red coloring matter on its stalks and leaves which highly discolors the juice, and which is not easily removed—a very objectionable feature. Experiments in labaratory showed that it could be removed by bone black.

The *India* sorghum reached maturity in August, remained nearly stationary till September, at which time suckers had appeared with heads forming rapidly. After that it lost rapidly until ground on 13th. It is however, a fine sorghum, of good size, and large sugar content, and worthy of further trial.

Stewart's Hybrid did not ripen till September, and even then its per centage of sugar was comparatively low. Results this year are not promising for this variety.

The same may be said about the *White Seeded* sorghum.

The *Early Orange* is fair in size and quality, and may perhaps yield to proper treatment and make an excellent variety for the South.

The *Early Amber* could not be thoroughly tested. A very bad stand was obtained, and the vacant spots were soon occupied by Guinea corn, making identification of the former difficult and hazardous.

On the 13th and 14th September, all the above varieties were cut and sent to the mill. Our vacuum pan and centrifugals had not then been put in place. Accordingly the juices from these

sorghums after defecation with sulphur and lime, were concentrated in evaporating pans and left under the hopes of graining them in a few days in the pan. But the vacuum pump ordered from New York was delayed till late in October, and when received and put in position, all the syrups had more or less undergone fermentation.

The results of harvest with analyses are however given.

RESULTS AND ANALYSIS OF MILL-JUICES.

VARIETY OF CANE.		Yield per acre, lbs.	Per cent of Extraction	Raw Juice. Total Solids.	Sucose.	Glucose.	Syrups. Total Solids.	Sucose.	Glucose.	Co efficient Purity.
H0ıduras,	a	34.050	63.5	13.50	9.7	....	59.4	41.6	....	70.
"	b	28.80	61.4	12.42	8.	....	64.8	41.4	....	64.
"	c	30.960	63.7	12.6	8.	....	66.6	50.	....	75.
Links,	a	19.050	57.	18.2	13.2	....	....	....	....	....
"	b	17.850	58.	17.82	12.9	....	64.8	46.2	....	71.
"	c	21.375	59.	17.64	12.7	....	....	....	....	....
	a									
Chinese,	b	12.900	....	15.84	10.9	....	59.4	44.2	....	71.
	c									
	a	15.525	....	16.92	11.9	....	....	....	....	....
India,	b	15.000	....	16.02	12.	....	66.20	49.4	....	74.6
	c	13.900	....	17.64	13.1	....		....		....
Stewart,		....	....	16.56	11.9	....	....		....	
White Seeded,		....	....	16.02	10.8	....	....	....	....	....
Early Orange.		....	....	17.64	13.1	....	59.4	....	....	....
Early Amber,		....	....	16 56	12.1	....	44.2	....	....	74.4

The results for the syrups were obtained by double polarization.

The last four were not weighed—they were analyzed seperately but were concentrated with 3 and 4.

The station was greatly disappointed in not working the above syrups in the pan. The delayed machinery was not put in place till the last of October, and by that time nearly all the syrups had fermented.

However our kind and always obliging neighbors, the Soniat Brothers, placed at our disposal, a patch of sorghum, (Early Amber) which had been sown for stock feed July 14, (after the Chinese variety had shown its highest amount of sugar on the Station). Of this sorghum they cut and delivered to the Station two and a half tons. At 10 a. m. grinding began. The cane was not fully ripe, analysis giving 12.8 total solids, 9.3 sugar and 71. purity coefficient.

The juice was very slightly sulphured, limed to neutrality, skimmings carefully removed, brushed, concentrated and sent to vacuum at 22° B. It then readily grained, and was centrifugalled at once, giving 80 pounds first sugars. The skimmings,

settlings and some of the juice, were neglected, the sole object being to make sugar out of sorghum. The molasses was at once boiled to string sugar, and in 24 hours had grained prettily—3 gallons of masse cuite yielding 7½ pounds of second sugar—the masse cuite weighing 12 pounds to the gallon—a yield of nearly 21 per cent. of second sugars.

The following data are taken from the records of the sugar house and labaratory:

Weight of sorghum, 2½ tons.

Mill extraction, 62.3 per cent.

One gallon juice required, 135 grains lime for neutrality.

One portion treated to neutrality and concentrated to 22.2° B.

Another portion treated to neutrality then made slightly acid with superphosphate of lime and concentrated.

Masse cuite made 286 pounds.

Sugar from masse cuite, 80 pounds.

Molasses from masse cuite, 206 pounds.

Analysis of Sugar.	
Sugar	93.40
Glucose	1.05
Ash	.74
Water	4.81
	100.00

Analysis of Molasses.	
Total solids	75.4
Sugar	51.4
Ash	5.97
Ash soluble in water	4.56

ANALYSES OF MILL JUICES, OCTOBER 22.

	Degrees Baume.	Specific Gravity.	Total Solids.	Sugar.	Glucose.	Acid Calculated as Malic	Ash.	Purity Coefficient.	Kind of Juice.
Expt. 1	7.1	1.0519	12.8	9.1	2.62	.0504	.....	69.	Raw Juice.
" 2	7.1	1.0519	12.8	9.5	2.65	.0378	.9875	74.2	" "
" 3	7.3	1.0536	13.2	8.6	2.48	.....	.....	64.4	Sulphured Juice.
" 4	7.2	1.0527	13.	8.2	2.47	.....	.....	63.	" "
" 5	7.2	1.0527	13.	9.1	2.24	.....	.....	70.	Limed Juice.
" 6	7.3	1.0536	13.2	8.9	2.38	.....	.....	67.42	" "
" 7	7.3	1.0536	13.2	....	2.48	.....	.....	.....	" "
" 8	22.2	1.1825	40.6	26.1	8.24	.....	.....	64.2	Concentrated.

ANALYSES MILL JUICES, OCTOBER 23.

	Degrees Baume.	Specific Gravity.	Total Solids.	Sugar.	Glucose.	Acid Calculated as Malic.	Purity Coefficient.	Kind of Juice.
Expt. 1	7.7	1.0566	13.9	9.7	2.21	.05	69.78	Raw Juice.
" 2	7.6	1.0555	13.7	8.7	2.63	....	63.50	Sulphured Juice.
" 3	7.7	1.0566	13.9	8.4	2.76	....	60.40	" "
" 4	7.9	1.0583	14.3	8.8	3.03	....	61.50	" "
" 5	8.	1.0591	14.5	8.1	3.00	....	55.80	" "
" 6	8.1	1.0596	14.6	8.6	2.57	....	58.8	Limed Juice.
" 7	7.8	1.0574	14.1	8.6	3.29	....	60.9	" "
" 8	8.4	1.0621	15.2	9.1	.....	....	59.8	" "
" 9	22.	1.1801	40.2	23.7	9.39	....	58.95	Concentrated Juice.
" 10	21.	1 1707	38.3	23.1	8.78	....	60.30	" "
" 11	26.2	1.2229	48.2	29.1	10.68	....	54.30	" "
" 12	18.	1.1432	32.8	18.8	.....	....	.....	Scums and Settlings.

In the sulphured juices above, besides the acids of the juice there was from .07 to .10 of sulphurous acid added by sulphuring.

After working this cane which was only partially ripe, low in sugar, and with so low a purity coefficient, our regrets at our inability to work some of the varieties grown on the station, were very greatly enhanced. If with this second crop, grown between July 14th and October 22d, and with no special attention either in cultivation or manure, so decided a success was obtained, we have, we think, from comparison of analytical results, every reason to have expected far better results from several of the varieties grown on the station. Now however, further tests as to the adaptability of sorghum as a sugar crop in the South are to be postponed until another season. In the meanwhile the station can only offer some suggestions. There are several varieties of sorghum which promise good tonnage, with fair quantity of sugar. These, by proper cultivation and manuring, and selection of seed, may become valuable adjuncts to the sugar cane in Louisiana. It is possible to grow two crops in a season on the same land. The seed from sorghum are valuable stock food and may be used as a substitute for corn and oats. They contain starch in large quantities and it has been suggested that they would make an excellent glucose syrup.

If good varieties of sorghum could be obtained which would yield sugar in paying quantities, (and the experiments here rather indicate such a probability), the costly and extensive plantation machinery now used only about sixty days in a year, could begin work in August on Sorghum, and continue till No-

vember, grind cane during November and December, and then devote January, February and March to the conversion of sorghum seed into glucose syrup.

This would keep the machinery going at least six months in a year, and would enable the planters to do at their own sugar houses what is now done for them as soon as their syrups and molasses reach the markets of the world, viz.: Mix them with glucose syrups. If there be money in mixing, and from the prevailing custom one would judge so, why not the planter enjoy the profit?

The above are some of the possibilities of sorghum. Will they be realized? *Nous verrons.*

RECORD OF WEATHER—KEPT BY LOUISIANA SUGAR EXPERIMENT STATION, FOR JULY.

Date	THERMOMETER.					RAIN FALL.
July.	9 A. M.	3 P. M.	9 P. M.	Minimum.	Maximum.	Inches.
1	79°	85°	87°	71°	89°	
2	86°	90°	85°	75°	95°	
3	86°	91°	85°	70°	95°	
4	87°	93°	79°	74°	96°	.07
5	83°	90°	86°	74°	94°	
6	81°	90°	79°	74°	93°	
7	84°	83°	81°	70°	91°	
8	83°	89°	81°	72°	92°	
9	78°	79°	79°	73°	85°	.35
10	76°	81°	80°	72°	85°	.32
11	84°	84°	79°	74°	85°	.02
12	82°	85°	81°	74°	92°	.16
13	81°	75°	80°	73°	90°	1.32
14	84°	89°	87°	72°	91°	
15	82°	90°	81°	75°	91°	
16	82°	85°	78°	71°	85°	
17	82°	86°	79°	69°	88°	
18	87°	88°	79°	68°	88°	
19	86°	90°	82°	71°	94°	
20	87°	90°	81°	73°	95°	
21	86°	91°	81°	72°	95°	
22	80°	80°	78°	77°	83°	
23	86°	82°	77°	72°	83°	
24	86°	86°	82°	73°	91°	
25	86°	85°	82°	75°	93°	
26	84°	86°	80°	77°	92°	
27	86°	86°	83°	76°	95°	.36
28	86°	87°	82°	78°	88°	.17
29	85°	88°	82°	75°	94°	
30	86°	89°	82°	75°	96°	
31	85°	89°	80°	76°	96°	

Total......................3.25 inches.

Highest Temperature...96°
Lowest Temperature ...68°

RECORD OF WEATHER KEPT BY LOUISIANA SUGAR FXPERIMENT STATION FOR AUGUST 1886.

Date. August.	THERMOMETER: 9 A. M.	3 P. M.	9 P. M.	Maximum	Minimum.	RAIN FALL. Inches.
1	82°	88°	81°	93°	76°	.42
2	85	87	80	93	76	.01
3	82	87	81	93	75	
4	86	90	83	93	75	
5	86	91	84	96	76	
6	88	88	79	97	77	.27
7	83	89	84	89	74	
8	82	86	77	87	72	
9	86	81	79	91	68	.17
10	83	86	79	87	72	
11	83	85	79	91	76	.21
12	84	89	81	91	70	
13	85	90	82	95	71	
14	82	....	....	93	74	
15	84	91	85	93	75	
16	88	95	85	95	77	
17	86	86	82	94	75	.16
18	85	91	82	93	74	
19	88	89	79	91	76	
20	86	91	81	92	75	
21	84	84	80	90	75	
22	82	....	80	86	76	
23	82	90	81	91	70	2.1
24	77	88	82	89	66	
25	85	87	78	89	75	
26	81	86	....	86	72	
27	....	84	81	89	73	
28	83	86	75	87	71	.61
29	79	84	80	88	73	.23
30	80	82	75	82	72	
31	80	85	76	85	72	

Total.....................4.18 inches.

Highest Temperature......97°
Lowest Temperaturə......66°

CORN.

BULLETIN No. 6

OF THE

LOUISIANA SUGAR EXPERIMENT STATION

AND

STATE EXPERIMENT STATION.

Wm. C. Stubbs, Ph. D.,

—DIRECTOR—

DECEMBER, 1886.

—ISSUED BY—

THOMPSON J. BIRD,

COMMISSIONER OF AGRICULTURE, BATON ROUGE, LA.

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STATE EXPERIMENT STATION,
BATON ROUGE, LOUISIANA.

Major T. J. Bird, Commissioner of Agriculture, Baton Rouge, La.:

I hand you herewith, for publication, a Bulletin on Corn, covering results of experiments on the State Experiment Station, Baton Rouge and Sugar Experiment Station, Kenner, La. Bulletins on Cotton and Sugar Cane will soon follow.

Respectfully,

WM. C. STUBBS, Director.

CORN.

Stands first, both in acreage and yield of the cereal crops of the United States. The total crop of the United States for the present year is estimated by the Department of Agriculture at Washington, at 1,650,000,000 bushels, or an average of 22 bushels per acre.

The Commissioner of Agriculture for the Stateof Louisiana, estimates the crop of this State just gathered at 16,299,375 bushels, grown upon 916,016 acres of land. Corn is grown more generally over the United States than any other crop, but the centre of maximum production is found in the prairie and the river bottoms of the West, where all the conditions of profitable growth exist in great perfection. Where the soil is susceptible of easy culture and adapted to improved implements with a fair stock of fertility, moistened with showers at short intervals during growing season and in a climate with sunny skies, and which permits of warm days and nights for a sufficient length of time to secure maturity there will be found the conditions suitable for large production. Neither excessive rains nor droughts are conducive to maximum results, but on the contrary, moisture in such quantities and at such intervals as to keep the ground damp, not wet.

The corn plant is emphatically a child of the sun. It cannot stand frost either in the spring or fall. The first, most of our progressive planters are painfully aware of; the second is more vividly impressed upon the minds of the Northwestern farmer. This sensitiveness to frost limits its cultivation in mountainous regions. The absence of sunshine, and the presence of damp weather prevents its cultivation in Northern Europe.

BOTANICAL RELATIONS OF CORN.

This plant is known to the botanist as "Zea Mays", and belongs to the cereals; but unlike other cereals, it has its staminate and pistillate flowers on different parts of the plant. The former is familiarly known as the tassel, and the latter as the silk. The latter receives the pollen from the former and thus impregnated forms the grain or seed. This natural arrangement of its parts affords abundant opportunity for variation, which has been done to a marvelous extent so that now we have in the United States, many hundred varieties, including all sizes, shapes, colors, hardness, number of rows, etc., etc. It is almost impossible to grow two varieties close to each other without mixing.

This property of corn offers a valuable suggestion to the thoughtful farmer; the necessity of annually selecting his seed. Sometimes stalks of fine size and healthy appearance but wanting in pistillate flowers (or seed producing organs) are permitted to fertilize the silks of other stalks. Good ears of corn may be produced from this union, which would be excellent for feeding purposes, but almost worthless for seed, since many grains would produce stalks with only the staminate flowers (tassels) and no ears. Sometimes as in suckers, a few naked grains appear with the tassel, and occasionally a few staminate flowers are found with the pistillate. A close examination of a stalk of corn, will reveal embryonic ears at several joints or nodes of the corn. By artificial means, several of these buds have been developed in the varieties known as "Prolific." In corn bearing only one ear, it is the upper bud that develops, and as the number of ears increase, the next buds below develop, and so on to three or five ears to a stalk. By constant selection and careful cultivation we can after a while produce a variety of one, two or more ears, and impress upon them the hereditary habit of reproducing the same number of ears for a long time. All of our Southern corn is divided into two classes,—Dent and Flint—names known and understood by all planters and farmers. The Dent is softer than the Flint and hence preferred for meal and stock feed, the ears are higher up on the stalk, and is not much disposed to sucker. The Flint usually suckers more, bears less ears, which grow closer to the ground, and seems to be harder, and freer from attacks of insects, particularly the weevel. For the last reason it is preferred by many planters, especially in South Louisiana, where a yellow Flint variety perfectly acclimated exists, and is called "Creole corn."

The origin of Indian corn is completely unknown. It was found in the possession of the Indians and by them highly prized, upon the discovery of America. How long they had been cultivating it, is only a conjecture, sufficiently long however to have established nearly all the varieties now known to us. Some botanists are disposed to place the original home of the corn plant in Mexico, but only one botanist, Herr Roezl, a German, has ever discovered a true Zea growing wild in that country. In the State of Guerrero, he found a small two rowed corn, with covered ears, small and hard grains which may be considered as the possible progenitor of our Indian corn.

The varieties of Indian corn are numerous, several agricultural museums containing as many as three hundred distinct kinds. There is no possible way for a plant to vary, that has not been successfully exemplified in corn. Time of maturity, height of plant, size of stalk, number of ears, number of rows on ear, shape and texture of grain, color of grain, size of grain, proportion of grain to cob, number of grains to ear, difference in chemical

composition. Its placticity is here well illustrated, and further adapts it to the varied conditions of soil climate and cultivation. Hence its extended distribution over so large an area. It can be cultivated on a large scale. mostly by machinery, as in the prairies of the West, or it may be grown in hills around the wigwam or hut of the savage and worked only with wooden or flint implements. It can be crushed to powder in the ponderous machinery of our large milling establishments, or pulverized slowly in the stone or wooden mortars of the barbarian. The product of both furnishes an article at once nutritious and wholesome as a food for man or his animals.

THE CULTIVATION OF CORN

Depends largely upon locality, and no fixed rules adapted to all countries can possibly be given. As a general rule, the custom which prevails in a community is the one best adapted to it. But this is not always true—a cultivation adapted to "new ground" will rarely succeed upon worn soils; yet we find many farmers to-day persistently following the practices of their fathers, forgetful of the fact that the latter worked virgin soil while they are contending with lands badly run down if not worn out. Changes in local conditions will often require changes in cultivation, and here as elsewhere, good judgment on the part of the farmer, is required. The best time to plant corn in the South is as early as possible, to insure it against the late frosts of spring. By this means, ample time is given to work it, and the corn is usually in a condition to be benefitted by the rains of May and June. It is the experience of the writer, corroborated by that of many practical farmers, that our surest and best crops of corn are from early planting. However, excellent crops may be made planted later and the writer has seen enormous yields made from corn planted as late as July. Corn should however, never be planted until the temperature of the earth at one inch is above 50° F. The prevailing custom of planting when the budding of red maple begins or the leaves of the white oak get as big as a squirrel's ear," is generally a correct one. In planting, the best of seed should be used. It is discouraging to find after the labor of a season, that you have nursed into full growth a stalk without a ear. This could ultimately be avoided by carefully raising and selecting annually seed. Every planter should have a patch each year for seed, and soon after tasseling, every stalk without a good ear of corn on it should have its tassel removed at once, to prevent further propagation of its kind. In this way seed may be obtained which will ultimately produce no barren stalks. The depth to plant depends entirely upon soils and moisture. Quick germination is desirable, and to secure this three conditions are imperatively demanded. Access of air, abundance of moisture and a temperature from 50°-90°F. The last is usually vouchsafed to us after the opening of the spring

but the other conditions are variable and cause frequently great losses. In early spring when our soils are usually well moistened, a depth of one to three inches will be found to give the best germination, provided the ground is pulverized and slightly packed upon the seed. Later a deeper depth may be required to furnish the moisture needed for germination. Sometimes after heavy beating rains of spring, the soil is so compacted as to exclude the air and the corn rots in the ground. This may sometimes be averted by passing a light harrow over the soil to break the crust.

Planting, once done exclusively by hand, is now so effectively and cheaply performed by machinery, that every planter who grows twenty acres of corn should have a corn planter. The same implement can be used for planting also cow peas. Both systems of planting, in rows and in checks or cross-rows, prevail in the South. Which is best adapted to a locality must be determined by the good sense of the planter.

In after cultivation the turn plow, the harrow, the horse hoe, the hand hoe, the cultivator, the sweep, the scooter and scrape, are all used in the South. It would be folly to prescribe a method to be followed by every planter, but in the South, the nearest approach that our environment will permit, is the practice of thorough preparation of soil, proper fertilization and as shallow cultivation thereafter as possible, the better it will be for our crop and our pocket. In wet and stiff lands, drainage is the first condition of success and all others are made subservient to this. Hence, high ridges, worked with turn plows are frequently found. Whenever possible, hand hoes should be dispensed with, as an element of cost, greater than the benefit conferred. In some portions of the South, the blades are stripped from the corn and converted into fodder for stock. Such a procedure is condemned by accurate experiments recently made on the Alabama Experiment Station. The injury to the corn proved greater than the value of the fodder saved, to say nothing of the labor in saving it. In the North "stover" is highly esteemed as a cattle feed during the winter.

FERTILIZERS REQUIRED FOR CORN.

In Bulletin No. 2, the following remarks were made in regard to manures for corn, which are herein inserted:

Although corn is the cereal crop of the United States, and excels in quantity all others combined, yet its manurial requirements have not been definitely settled. This is due to the fact that it is grown in all kinds of soil and almost in all latitudes. No plant is susceptible of more differentiation under cultivation, there being no end to varieties; in size from the tiny pop corn to the mammoth prolific; in color, from the black Mexican to the purest white; and in hardness from the soft dent to the re-

fractory flint. A similar diversity of opinion prevails as to the composition of the manure best adapted to its growth. Mr. Lawes, of England, placing it among cereals, prescribes Nitrogen in heavy doses. M. Georges Ville, of France, assigns it a place among the Phosphoric Acid plants, and recommends for it manures containing a large amount of Acid Phosphate. Mr. Harris, in his book, "Talks on Manures," is inclined to place it among cereals, but mentions some facts which would indicate that its feeding capacities are like the pea and clover. Other leading scientific men have given formulas for it, varying largely in cost and in quantities of the chief ingredients. Through the instrumentality of Professor W. O. Atwater, ex-director of the Connecticut Experiment Station, a large number of experiments were tried all over the eastern part of the United States to test the manurial requirements of corn. In his published "Report of Experiments" are given the results, which are far from being satisfactory. Of the 80 results reported, Phosphoric Acid was the regulating ingredient in 29, Potash in 12 and Nitrogen in 4. Phosphoric Acid was more or less effective in 31, Potash in 24, Nitrogen in 4. Phosphoric Acid was indifferent, *i. e.* produced no results, in 17, Potash in 44 and Nitrogen in 46.

One positive conclusion can be drawn from these results, viz.: that the soils operated on varied greatly in composition. This conclusion, however, suggests the propriety of each individual farmer trying experiments upon his own soils. However, in the South, where clean culture has well nigh exhausted our soils of vegetable matter, and where Phosphoric Acid is nearly everywhere wanting, it has been found that both Nitrogen and Phosphoric Acid are imperatively needed in manures for corn.

To test manurial requirements of corn in Louisiana a series of unlike experiments were made at both the Sugar Experiment Station and at the State Experiment Station. The former is located in the black lands just above New Orleans and the latter upon the bluff lands at Baton Rouge. Below will be found the experiments with results.

At the Sugar Experiment Station a plat was devoted to varieties which are herein inserted.

CORN EXPERIMENTS AT SUGAR EXPERIMENT STATION, KENNER, LA.

PLAT NO. 10—VARIETIES.

No. 1—Yellow Flint, grown on titled drained land.
No. 2—Yellow Flint, grown from Western seed.
No. 3.—Mexican Flint, grown from seed obtained at Exposition of 1885.
No. 4—Creole Corn.

No. 5—Cross between Mexican and Creole.
No. 6.—White Mexican from seed obtained at Exposition of '85.

These varieties were grown on the Alice C. plantation, St. Mary's parish and were presented by Mr. D. R. Calder.

Each of above experiments were divided into 3 parts—"a," "b" and "c;" "a" manured with an Ammoniated Acid Phosphate at rate 300 lbs. per acre. "b" receiving no manure and "c" an Ammoniated Acid Phosphate at rate of 300 lbs. per acre with Potash in form of Muriate at rate 60 lbs. to acre and the following results were obtained:

Experiment No. 1—Yellow Flint from Tiled Drained Land.

Manured used.	Yield per acre.
(a) 300 lbs. Amoniated Acid Phosphate.	1380 lbs.
(b) Nothing.	1140 "
(c) 300 lbs. Ammoniated Acid Phosphate, 60 lbs Muriate Potash,	1500 "

REMARKS—MEDIUM HEIGHT—MIXED GRAIN—ONE EAR TO THE STALK

Experiment No. 2—Yellow Flint from Western Seed.

Manures used.	Yield per acre.
(a) Like No. 1	1200 lbs.
(b) " " 1	1100 "
(c) " " 1	1170 "

REMARKS—MEDIUM HEIGHT--SEED PURE—EARS NOT WELL FILLED,

Experiment No. 3—Mexican Flint.

	Yield per acre.
(a) Manured	1260 lbs.
(b) like	1020 "
(c) No. 1	1200 "

REMARKS—MEDIUM HEIGHT—GOOD SEED—WORTHY OF FURTHER TRIAL.

Experiment No. 4—Creole Corn.

	Yield per acre.
(a) Manured	900 lbs.
(b) like	796 "
(c) No. 1	771 "

REMARKS—STAND POOR—GOOD HEIGHT--SEED SMALL.

Experiment No. 5—Cross of Mexican and Creole.

	Yield per acre.
(a) Manured	1530 lbs.
(b) like	1435 "
(c) No. 1	1575 "

REMARKS—A TALL CORN—STAND POOR—2 EARS TO STALK—WORTHY OF FTRTHER TRIAL.

Experiment No. 6—White Mexican.

		Yield per acre.
(c)	300 lbs Amoniated Acid Phosphate 60 lbs Muriate Potash	[illegible] lbs.

REMARKS—A BEAUTIFUL WHITE CORN—QUITE PROLIFIC, AND WORTHY OF FURTHER TRIAL.

Cultivation of Above.

Land broken with two-horse plow, harrowed, furrows, opened with plow, seed deposited two feet apart, 3-5 grains to hill, on March 19th and covered with hoes, corn worked twice with plows, gathered September 7th.

EXPERIMENT IN FERTILIZERS, ON CORN AT THE SUGAR EXPERIMENT STATION.

The soil upon which this corn was grown has been pastures for some years. The ditches had been filled up; the quarter drains neglected. Accordingly it was but imperfectly prepared; in fact not in a condition to test the value of fertilizers. Since it was the only field accessible, the experiments were made with the best preparation and cultivation, which our time and means permitted. The soil is stiff black clay. A veritable "terre gras"—whose physical condition can only be ameliorated by thorough drainage and deep tillage.

It is by no means deficient in plant food as the following analysis made at the Station will show:

ANALYSIS OF PLAT NO. 17—CORN LAND.

Insoluble matter	75.89 per cent
Soluble Silica	.01
Potash	.37
Soda	.48
Magnesia	.02
Lime	.32
Iron Oxide, Aluminic Oxide,	7.99
Phosphoric Acid	.12
Sulphuric Acid	.04
Organic matter	16.00

PREPARATION AND CULTIVATION.

The land was broken flat with four-horse plow, harrowed; rows laid off five feet apart with one-horse plow; manures deposited in the open furrow and were bedded upon with two-

horse plow, March 25th, 1886. These beds were harrowed on April 2d, and planted April 3d. Seed used Kentucky Yellow Flint corn, grown one year by Soniat Bros. and by them donated to the Station. The growth was small, as is common with Western seed until acclimated, but it eared off very well, and the yield would have been quite fair, but for the black birds which destroyed quantities of it, particularly upon those plats where the manures had induced early maturity. The experiments with the Sulphate of Ammonia and cotton seed meal, mixed with mineral manures, were very fine and were the first to mature, and hence suffered more severely than any other portion of the field. It is greatly to be regretted that the results of these experiments were so seriously vitiated, expecially those in Nitrogen (15–40).

The results given below are those ultimately harvested and by no means represent the actual yield of the fertilizers applied. The corn was gathered September 6th, 1886.

EXPERIMENTS IN CORN PLAT NO. 17.

Expt. No.	Fertilizers used.	Quantiy per acre.	Yield per acre in lbs.
1	Compost of { Stable Mashue, Cotton Seed, Acid Phosphate.	100 Bushels	830 Pounds.
2	Sol. Pacific Sugar Guano.......	300 Pounds.	1180 "
3	Sol. Pacific Guano	300 "	980 "
4	Rogers Sugar,Goods............	300 "	965 "
5	Studniczka's Goods............	300 "	1135 "
6	Stono Guano..................	300 "	970 "
7	Nothing	.... "	885 "
8	Sterns Am'd Guano............	300 "	865 "
9	Sterns Sugar Goods............	300 "	875 "
10	Fosters Tormula...............	300 "	1060 "
11	Acid Phosphate................	300 "	1135 "
12	Nothing	.... "	742 "
13	Tankage	300 "	760 "
14	Tankage } Ashes Cotton Hulls }	300 } 100 } "	730 "
15	Nitrate Soda..................	150 "	1137½ "
16	Sulphate Ammonia.............	112½ "	837½ "
17	Nothing	.... "	965 "
18	Dried Blood..................	225 "	1000 "
19	Cotton Seed Meal	375 "	1225 "
20	Acid Phosphate } Muriate Potash } M'xed Minerals	300 } 150 } "	838 "
21	Mixed Minerals } Nitrate Soda ½ Ration }	450 } 150 } "	750 "
22	Nothing	.... "	1027 "
23	Mixed Minerals } Nitrate Soda ⅔ Ration }	450 } 300 } "	928 "
24	Mixed Mineral } Netiate Soda 3-3 Ration }	450 } 450 } "	1000 "
25	Mixed Minerals................	450 "	906 "
26	Mixed Minerals } Sulphate Ammonia ½ Ration } ..	450 } 112½ } "	650 "
27	Nothing	.... "	975 "
28	Mixed Minerals } Sulphate Ammonia ⅔ Ration } ..	450 } 225 } "	706 "
29	Mixed Minerals } Sulphate Amonia 3-3 Ration } ..	450 } 337½ } "	1350 "
30	Mixed Minerals	450 "	712 "
31	Mixed Minerals } Dried Blood ½ Ration }	450 } 225 } "	687½ "
32	Nothing	.... "	1031 "
33	Mixed Minerals } Dried Blood ⅔ Ration }	450 } 450 } "	775 "
34	Mixed Minerals } Dried Blood 3-3 Ration }	450 } 675 } "	1125 "
35	Mixed Minerals.................	450 "	675 "
36	Mixed mineral } Cotton Seed Meal ½ Ration } ..	450 } 375 } "	450 "
37	Nothing	.... "	843 "
38	Mixed Minerals } Cotton Seed Meal ⅔ Ration } ..	450 } 750 } "	625 "
39	Mixed Minerals } Cotton Seed Meal 3-3 Ration } ..	450 } 1125 } "	1175 "

Attention is again called to apparent results on experiments 15 to 39. Here is an excellent opportunity to judge of the injurious effects of black birds for only a few days. These experiments, except those unmanured, were the first to mature and presented a beautiful appearance, just before they were attacked by the birds. The superior effects of these fertilizers could be easily seen and distinguished for a half of a mile and yet nearly the entire crop of corn was destroyed in less than a week, by thousands of these pests and the results harvested, give an increased yield to unmanured plats. The Sulphate of Ammonia and Cotton Seed Meal groups were far in excess of every manure used and seem well adapted to the requirements of this crop and soil.

On April 20th the remaining experiments on this plat were planted with Yellow Flint Creole corn, also kindly donated by the Soniat Bros.

Expt. No.	Kind of Fertilizer.	Am't used per acre		Yield per acre.	
40	Cotton Seed Meal Orchilla Guano	300 300	Pounds.	2225	Pounds.
41	Nothing	....	"	1705	"
42	Ouchilla Guano	300	"	1590	"
43	Cotton Seed Meal Charleston Floats	300 300	"	1955	"
44	Nothing	....	"	1665	"
45	Floats	300	"	1600	"

These experiments were not interrupted by the birds. The corn was tall and well eared. The rains of June forced it so rapidly to growth as to preclude the last working or "laying it by." It accordingly received only one plowing after it was up. The effects of cotton seed meal are very apparent. Not so with either Orchilla or Floats, both of which are insoluble forms of Phosphoric Acid. Perhaps the period of growth was too short to permit of their assimilation by the corn, since both are only slowly available as plant food.

The following experiments were conducted at Baton Rouge.

PREPARATION AND CULTIVATION OF THE LAND.

Broken with two-horse plow, harrowed; furrows opened with one-horse plow $4\frac{1}{2}$ feet apart; manures deposited April 2d and land bedded; corn planted 14th and 15th, with seed obtained from Mr. Jno. McQuade and Mr. Jno. Gass; off-barred May 6th; hoed and dirt thrown back on the 12th; first furrow thrown back with turn plow, after subsoiling with scooter and second furrow with short scooter and heel scrape; replanted when hoed; replanted again 24th of May; plowed with scooter and scrape,

June 3d and 4th; after which the rains prevented further cultivation; the corn was dropped three feet apart in the drill and thinned to one stalk in a hill, but the bud worm played such sad havoc, that twice replanting failed to secure the perfect stand desired. It was gathered October 8th.

CORN EXPERIMENTS.

No. Expt.	Manures used.	lbs. pr. acre	Yield in lbs. per acre.	Bushels per acre.
1	Nothing	....	1640 lbs.	21.58 Bushels
2	Nitrate Soda	140 lbs.	2050 "	26.97 "
3	Sulphate Ammonia	1037-11 "	2130 "	28.03 "
5	Cotton Seed Meal	310 "	2250 "	29.61 "
6	Acid Phosphate	280 "	1680 "	22.10 "
7	Muriate Potash	90 "	1650 "	21.71 "
8	Cotton Seed Meal, Acid Phosphate	310, 280 "	2270 "	29.87 "
9	Cotton Seed Meal, Muriate Potash	310, 90 "	2440 "	32.10 "
10	Acid Phosphate, Muriate Potash } Mixed Minerals.	280, 90 "	2160 "	28.40 "
11	Mixed Minerals, Nitrate Soda ⅓ Ration	370, 70 "	2450 "	32.24 "
12	Mixed Minerals, Nitrate Soda ⅔ Ration	370, 140 "	2650 "	34.87 "
13	Mixed Minerals, Nitrate Soda 3-3 Ration	370, 210 "	2700 "	35.53 "
14	Mixed Minerals, Sulphate Ammonia ⅓ Ration	370, 51 9-11 "	2270 "	29.87 "
15	Mixed Minerals, Sulphate Ammonia ⅔ Ration	370, 1037-11 "	2780 "	36.58 "
16	Mixed Minerals, Sulphate Ammonia 3-3 Ration	370, 1555-11 "	2880 "	37.89 "
17	Mixed Minerals	370 "	2450 "	32.24 "
21	Mixed Minerals, Cotton Seed Meal ⅓ Ration	370, 155 "	2900 "	38.16 "
22	Mined Minerals, Cotton Seed Meal ⅔ Ration	370, 310 "	2690 "	35.39 "
23	Mixed Minerals, Cotton Seed Meal 3-3 Ration	370, 465 "	2260 "	29.73 "
24	Mixed Minerals	370 "	2460 "	32.37 "
25	Nothing	....	2240 "	29.47 "
26	Cotton Seed Meal, Muriate Potash, Dis. Bone Black } Basal, Mixture ⅓ Ration.	310, 90, 120 "	2420 "	31.84 "
27	Basal Mixture, Dis. Bone Black ⅔ Ration	400, 240 "	2770 "	36.45 "
28	Basal Mixture, Dis. Bone Black 3-3 Ration	400, 360 "	3200 "	42.11 "
29	Basal Mixture	400 "	3150 "	41.45 "
30	Basal Mixture, Acid Phosphate ⅓ Ration	400, 140 "	3130 "	41.49 "
31	Basal Mixture, Acid Phosphate ⅔ Ration	400, 280 "	2740 "	36.05 "
32	Basal Mixture, Acid Phosphate 3-3 Ration	400, 420 "	2610 "	35.26 "
33	Basal Mixture, Orchulla Guano ⅓ Ration	400, 140 "	2830 "	38.16 "
34	Basal Mixture, Orchulla Guano ⅔ Ration	400, 280 "	2810 "	37.89 "
35	Basal Mixture, Orchilla Guano 3-3 Ration	400, 420 "	2700 "	35.53 "
36	Basal Mixture	400 "	2560 "	33.69 "

CORN EXPERIMENTS—*Continued.*

No. Expt.	Manures used.	lbs. per acre.	Yield in lbs per acre.	Bushels per acre.
37	Basal Mixture, Bone Dust ⅓ Ration	400 140 lbs.	2700 lbs.	35.53 Bushels
38	Basal Mixture, Bone Dust ⅔ Ration	400 280 "	2730 "	35.92 "
39	Basal Mixture, Bone Dust 3-3 "	400 420 "	2270 "	29.87 "
40	Basal Mixture, Charleston Floats ⅓ Ration ..	400 140 "	2370 "	31.19 "
41	Basal Mixture, Charleston Floats ⅔ Ration ..	400 280 "	2150 "	28.29 "
42	Basal Mixture, Charleston Floats 3-3 Ration ..	400 420 "	2240 "	29.47 "
43	Basal Mixture..................	400 "	2260 "	29·73 "
44	Cotton Seed Meal, Acid Phosphate, Kanite ⅓ Ration — Meal Phosphate ⅓ Ration.	310 280 200 "	2320 "	30.53 "
45	Meal Phosphate, Kanite ⅔ Ration	590 400 "	2540 "	33.42 "
46	Meal Phosphate, Kanite 3 3 Ration	590 600 "	2530 "	33.29 "
47	Meal Phosphate................	590 "	2290 "	36.13 "
48	Meal Phosphate, Sulphate Potash ⅓ Ration	590 45 "	2500 "	32 89 "
49	Meal Phosphate, Sulphate Potash ⅔ Ration	590 90 "	2420 "	31 84 "
50	Meal Phosphate, Sulphate Potash 3-3 Ration	590 135 "	2450 "	32.24 "
51	Meal Phosphate................	590 "	2460 "	32.37 "
52	Meal Phosphate, Muriate Potash ⅓ Ration	590 45 "	2170 "	28.55 "
53	Meal Phosphate, Muriate Potash ⅔ Ration	590 90 "	2120 "	27.89 "
54	Meal Phosphate. Muriate Potash 3-3 Ration	590 135 "	2220 "	29 21 "
55	Cotton Seed (Raw)............	1050 "	1840 "	24.21 "
56	Cotton Seed Acid Phosphate (Raw)	1050 280 "	1990 "	26.19 "
57	Cotton Seed Acid Phosphate (Raw) Kinite	1050 280 200 "	2040 "	26.84 "
58	Compost......................	35 Bushels	2000 "	27.11 "
59	Compost Kinite, ...	70 " 200 Pounds.	2370 "	31.19 "
60	Cotton Seed Meal, Cotton Hull Ashes	310 280 "	1960 "	25.79 "
61	Cotton Seed Meal, Cotton Hull Ashes .... Gypsum	310 280 140 "	2000 "	26.32 "
62	Tankage......................	300 "	2130 "	28.03 "
63	Tankage, Ashes Cotton Hulls	300 280 "	2320 "	30.53 "
64	Tankage. Ashes Cotton Hulls .... Gypsum	300 280 140 "	2200 "	28.95 "
65	Studniczka's Guano	500 "	2170 "	28.55 "
66	Planters Fertilizer............	500 "	2040 "	26.86 "
67	Nothing	....	1840 "	24.21 "

EXPERIMENTS.

Nos. 4, 18, 19 and 20 are omitted from above, because on account of the delay in getting the dried bloed, they were not planted for ten days after.

The difference in yields shows how strongly seasons may effect results.

The corn planted April 15th had very favorable seasons, that on 25th did not. Both received some number of workings. See the results:

No. Expt.	Manures used.	Yield per acre	Bushels.	
4	200 lbs Dried Blood.	910 lbs.	11.97	Bushels.
18	100 lbs Dried Blood ½ Ration / Mixed Minerals	1210 "	15.92	"
19	200 lbs. Dried Blood / Mixed Minerals ⅔	1520 "	20.00	"
20	300 lbs. Dried Blood / Mixed Minerals 3-3	1250 "	16.50	"

In the above we have counted as a bushel 76 pounds corn on the ear with a small amount of the shuck attached.

The object of these experiments was to test the value of the different forms of Nitrogen, Phosphoric Acid and Potash (the chief ingredients of all fertilizers) upon this soil. Accordingly there has been used all the forms of Nitrogen accessible. Mineral Nitrogen, in form of Nitrate Soda and Sulphate of Ammonia; Vegetable Nitrogen in Cotton Seed Meal and Animal Nitrogen in Dried Blood and Tankage. Of Phosphates there has been tried; the Soluble in Dissolved Bone Black and Acid Phosphate and the Insoluble in Bone, Orchilla Guano and Charleston Floats. The last is the natural Phosphate of South Carolina, reduced to an impalpable powder and Orchilla Guano is a natural bird Phosphate from the Caribbean Sea. The Potash Salts used are from the Prussian mines, Kainite being the crude product and the others manufactured from it.

Tankage, the refuse of the slaughter houses, is a mixture of Dried Blood, Bone and Meat. The compost is prepared according to formula given in Bulletin No. 2. For a further description of above manures see Bulletin No. 2, pages 8 *et seq*.

QUESTIONS ASKED OF THESE EXPERIMENTS.

1. Is this soil in need of Nitrogen to grow corn?
2. If so in what form and quantity?
3. Is Phosphoric Acid needed?
4. If so in what form and quantity?
5. Is Potash needed?
6. If so in what form and quantity?
7. Comparative effects of popular manures?

By examining the above experiments we will find that Nos. 2, 3, 4 and 5, put the question as to the requirements of this soil for Nitrogen alone and what form of it is best.

The combination of these forms of Nitrogen in different quantities with mixed Minerals, are also used, by the side of mixed Minerals alone, to tell both the form and the quantity of Nitrogen best adapted to growth of corn on this soil.

Experiment No. 6 is a question as to the need of Phosphoric acid alone on this soil.

Experiment No. 7 is a similar question as to Potash.

Experiment No. 8. combines Nitrogen, and Phosphoric Acid while No. 9 combines Nitrogen and Potash.

Nos. 10, 17 and 24, combines Phosphoric Acid and Potash. Further down combinations of Phosphoric Acid and Potash. similar to those of Nitrogen, already described, are found.

By tabulating these carefully, results of great value can be obtained—not in one year—but through several years, when the modifying factors of seasons, culture, etc., can be eliminated as far as possible. Accordingly these experiments will be repeated on the same soil for a series of years and at the end results calculated. Till then they serve only as suggestions.

The average of the 3 unfertilized plats is ....1906 lbs.
The average of the 3 Nitrogen plats, Nos. 2, 3 and 5 is.2143 "

Gain by Nitrogen alone .... 237 lbs.

The average of the 3 Mixed Minerals, Nos, 10, 17, 24 is.2356 lbs.
The average of the 3 Nitrogen Groups, 11, 12, 13 / 14, 15, 16 / 21, 22, 23 } is 2620 "

Gain by Nitrogen in combination............... 264 lbs.

Very nearly similar results. The different forms of Nitrogen give:

Nitrate Soda, Groups Nos. 11, 12 and 13..............7800 lbs.
Sulphate Ammonia, Groups Nos. 14, 15 and 16........7930 "
Cotton Seed Meal, Groups Nos. 21, 22 and 23 ....7850 "

Practically no difference.

Applying the question as to quantity needed, we have:

Sum of ⅓ Rations, Nos. 11, 14 and 21.................7620 lbs.
" of ⅔ Rations, Nos. 12, 15 and 22.................8120 "
" of $\frac{3}{3}$ Rations, Nos. 13, 16 and 23.................7840 "
" of 3 Mixed Minerals, 10, 17 and 24................7070 "

It is plain from above that increased quantities of Nitrogen have not paid this year.

Examining for Phospdoric Acid, we find:

The average of the 3 Basal Mixtures is ....2656 lbs.

The average of 5 Phosphoric Groups 26, 27, 28
30, 31, 32
33, 34, 35 2638 lbs.
37, 38, 39
40, 41, 42

or no gain, but examining them as to form of Phosphoric Acid, we have:

Average of Dis. Bone Black, Group 26, 27, 28..............2796
" of Acid Phosphate, Group 30, 31, 32..............2826
" of Orchilla, Group 33, 34, 35...................2780
" of Bone Dust 37, 88, 39.........................2533
" of Floats, Groups, 40, 41, 42 2253

A slight gain on three and a loss on the rest. In other words the Phosphoric manures have not this year greatly benefitted the crop, in any form and in any quantity.

Referring to Potash we have:

Average of Meal Phosphate Nos. 47 and 51 is ....2375 lbs.

Average of 3 Potash Groups Nos. 44, 45 and 46
38, 49 and 50 2363 "
52, 53 and 54

or no gain for Potash.

The different forms of Potash yield as follows:

Average of Kanite Nos. 44, 45 and 46................ 2463 lbs.
" of Muriate Nos. 48, 49 and 50................ 2456 "
" of Sulphate Nos. 52, 53 and 54 .... 2170 "

or a slight increase for Kanite and Muriate, with a loss for the Sulphate.

It is clear from above that none of the manures used *paid.* The reason may be found in the fact that there was not corn enough on the ground to make a very heavy yield. The rows were 4½ feet apart and hills 3 feet, and only one stalk left to the hill. The natural fertility of the soil, under the very favorable season readily developed and matured such a stand, hence small increase, wherever manures of every kind were used.

The truth is the land is much better than it seemed to be and it must hereafter be treated more heroically. Larger stands with the same manures may hereafter show more decisive results.

RECORD OF WEATHER—KEPT BY LOUISIANA SUGAR EXPERIMENT STATION, FOR SEPTEMBER, 1886.

Date	THERMOMETER.					RAIN FALL.
Sept.	9 A. M.	3 P. M.	9 P. M.	Minimum.		Inches.
1	76°	84°	74°	84°	65°	
2	83°	88°	77°	89°	66°	
3	84°	84°	76°	85°	72°	.28
4	84°	86°	77°	87°	70°	
5	84°	85°	78°	86°	70°	
6	82°	86°	77°	88°	73°	
7	82°	86°	79°	86°	71°	.35
8	82°	84°	77°	85°	71°	
9	80°	82°	79°	85°	73°	
10	80°	88°	78°	88°	70°	
11	83°	79°	77°	90°	72°	.05
12	84°	....	80°	91°	72°	
13	....	88°	79°	90°	71°	
14	81°	81°	79°	82°	75°	.23
15	83°	87°	75°	88°	73°	
16	81°	87°	80°	89°	69°	
17	84°	89°	80°	90°	73°	
18	84°	86°	83°	88°	75°	
19	78°	82°	79°	83°	74°	.26
20	79°	89°	75°	83°	74°	
21	80°	78°	77°	84°	71°	
22	81°	86°	77°	87°	73°	
23	84°	84°	77°	88°	72°	
24	80°	75°	77°	83°	74°	1.8
25	75°	....	76°	83°	73°	1.5
26	79°	78°	77°	81°	73°	.65
27	81°	84°	75°	87°	72°	
28	77°	84°	75°	87°	68°	.17
29	68°	71°	67°	76°	66°	
30	72°	76°	67°	76°	59°	
			Total	....	....	5.24 inches.

Maximum Temperature...91°
Lowest Temperature .....59°

RECORD OF WEATHER KEPT BY LOUISIANA SUGAR FXPERIMENT STATION FOR OCTOBER 1886.

Date.	THERMOMETER:					RAIN FALL.
August.	9 A. M.	3 P. M.	9 P. M.	Maximum	Minimum.	Inches.
1	71°	78°	68°	78°	63°	
2	64	67	64	71	55	
3	70	....	69	77	56	
4	75	81	68	81	62	
5	....	79	68	79	57	
6	73	....	75	79	55	
7	79	79	73	83	56	
8	79	80	73	82	64	
9	79	80	....	83	67	
10	78	....	75	82	67	
11	74	79	77	83	68	
12	81	83	77	83	72	1.
13	81	81	77	85	72	
14	79	85	74	87	71	
15	71	75	66	86	76	
16	69	74	64	74	60	
17	72	....	70	79	56	
18	79	80	70	85	67	
19	73	79	69	85	65	
20	72	80	66	81	60	
21	74	82	64	82	60	
22	76	82	65	83	59	
23	77	....	68	82	57	
24	78	82	66	83	59	
25	78	81	69	81	58	
26	68	70	64	70	65	
27	58	63	54	63	53	
28	54	60	45	61	42	
29	54	....	....	65	39	
30	57	....	50	69	40	
31	....	69	53	70	42	

Total.....................1. inch.

Maximum Temperature......87°
Minimum Temperature......39°

SUGAR CANE

(FIELD EXPERIMENTS.)

BULLETIN No. 7

OF THE

LOUISIANA SUGAR EXPERIMENT STATION

Wm. C. Stubbs, Ph. D.,

—DIRECTOR—

KENNER, LA., JANUARY, 1887.

—ISSUED BY—

THOMPSON J. BIRD,

COMMISSIONER OF AGRICULTURE, BATON ROUGE, LA.

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LOUISIANA SUGAR EXPERIMENT STATION,
KENNER, LOUISIANA.

Major T. J. Bird, Commissioner of Agriculture, Baton Rouge, La.:

Dear Sir—I hand you herewith a Bulletin covering "Field Experiments" in Sugar Cane made during the past year. Bulletins covering "Laboratory" and "Sugar House Experiments" will follow.

Respectfully,

WM. C. STUBBS, Director.

SUGAR CANE.

HISTORY.

From ancient historical writings it is learned that sugar cane came originally from India. Pliny, the older, Varro, and Seneca, well known Latin authors, speak of it. India may then, with certainty, be called the birth place of sugar cane. Thence it passed into China, where its cultivation has been carried on for immemorial time. It can then be traced into Arabia, Nubia, Ethiopia and Egypt. About the year 1500 A. D., after the crusades, the Venetians introduced it into Syria, Cyprus and Sicily. Later, Dom Henry, King of Portugal, introduced it into the Madeira and Canary Isles, where was manufactured for 300 years, all the sugar used in Europe. Since that time it has been slowly supplanted by the vine. Portugal at end of this epoch sent it to Saint Thomas. After the discovery of America, Peter Etienza introduced it on the island of St. Domingo, and from this island it has spread over the tropical and semi-tropical portions of North and South America. The history of the sugar cane in Louisiana is too well-known to require repetition here.

BOTANICAL RELATIONS.

Sugar cane belongs to the large family of grasses (graminaciæ; to the tribe andropogon, and its botanical name is *saccharum officinarum or arundo saccharifera.* Sugar cane is a gigantic stalk 6 to 12 feet in height, erect during growth, but bent or reclined, at maturity. Its roots are fibrous and lateral stretching several feet in every direction, and usually not penetrating the soil to any great depth. Hence its instability in loose or soft soils, and its liability to be blown down by wind.

Its cylindrical stalk is composed of nodes and internodes, sometimes reaching as high as 80 in number. These joints are long or short, according to variety grown, or to favorable or unfavorable conditions of growth. The upper part of each joint divides into two parts, the inner one forming the rind of the next joint above, and the outer one uniting with cells from within, forms the leaf. On the stalk near the nodes, occur a white, pulverulent, waxy substance, called *cerosin.* Its chemical composition is $C_{24} H_{48} O$, and would be called in chemistry, an alcohol of rhe fatty series. The color of the stalk depends upon the variety cultivated. The leaves of the cane are alternate, clasping, pale to dark green in color, receding from the stalk during growth, and falling off at maturity. At the base of each leaf is an eye or bud, which contains the germ of a cane, and is

the *true seed of the sugar cane.* Around the stalk at the eye, are several rows of semitransparent points, which produce roots when the cane is placed in contact with moist earth. Just above these rows is a light colored semitransparent narrow band which clearly divides the lower from the upper joint. In tropical countries the cane flowers, first sending forth a long shoot (arrow), upon which is borne a panicle of sterile flowers. The flowers never produce seeds. In this respect it resembles the banana and agave.

The inference that sugar cane, coming originally from India would require a warm, moderately damp climate, with intervals of dry weather is fully sustained by experiences in its culture. It appears also to thrive better near the sea; whether this is due to the extensive moisture existing in the prevailing sea breezes, or whether the latter bear inward certain saline salts which increase the fertility of the soils, is yet an uncertain question.

Though cane is cultivated in countries varying greatly in climate and temperature, yet it has been found to succeed best when the main average temperature is between 60° and 90° F. and with an annual rainfall of from 60 to 80 inches. These are natural conditions best adapted to its growth, but there are countries where the deficiency of rain fall can easily be remedied by irrigation, a practice which might sometimes be successfully and cheaply applied in Louisiana. But while this amount of rain and this mean temperature is necessary to its most successful growth; another condition is essential to the accomplishment of the latter, viz.: Proper distribution of both. Two distinct seasons usually exist in countries of highest productions—the one warm and rainy, lasting from 4 to 6 months, with a mean temperature of 80 to 90° F; the other, dry, or very moderately rainy, and a mean temperature about 70° F. The first is a season of rapid growth and development; the second is a period of the arrest of growth, the elaboration of sugar and the slow evolution of perfect maturity. Again a large amount of humidity in the air (70 per cent. at least) is conducive to best results. Bright, sunshiny days, with dry winds, are therefore prejudicial.

SOILS ADAPTED TO CANE.

Are those naturally rich and filled with vegetable matter. However, when cane is planted upon soils of medium fertility and irrigated properly, it will, with the aid of judicious manures, yield well and give highly remunerative results. Climate, rainfall and manures, are far more essential factors in cane culture than soils.

In fertile, fresh, friable and deep soils, with proper rainfall, the cane is well formed, large and full of sugar.

In sandy and light soils, the canes, without manure, are small but very sugary. Calcareous soils develop a superior cane

rich in sugar and easily worked. In rich alluvial soils, not properly drained, or too rich in certain salts, the canes though fine in appearance, are poor in juice, work difficultly and produce a great deal of molasses.

A complete study of the sugar soils of Louisiana was begun last summer, and samples were analyzed from Jefferson, St. Bernard, St. Mary, Terrebonne, St. Charles, Ascension, Assumption and Rapides. This work will be continued by the station during the summer months until finished, when a special Bulletin on the sugar soils of Louisiana will be issned.

The culture of cane depends entirely upon the character of the soil. That culture which will keep the soil porous, pulverable, free from weeds and which will disturb the roots of the cane the least, is the best. Every planter should aim in cultivation to accomplish all these as nearly as possible.

Field Experiments in cane at the station during the past year were of of four kinds, as given in Bulletin No. 3, issued in April 1886:

1st. Germination questions.
2nd. Physiological questions.
3d. Varieties best adapted to Louisiana.
4th. Manurial requirements.

GERMINATION QUESTIONS.

It has long been a question among planters whether to plant the tops, the entire stalk, or only the matured part. The practice of planting the green unmatured tops is the one suggested by economy, since these contain little or no sugar, and are frequently thrown away. This practice is, however, severely criticised by some, upon reasons drawn from known principles of vegetable physiology. The cane, say they, has only sterile flowers and consequently give no seed or grains. Therefore the eyes of the cane are intended to replace the true seed or grain. In all seed bearing plants, those seed germinate and fruitify best, which are permitted to reach perfect maturity. Therefore in imitation of this natural law, we must seek that part of the stalk which contains the largest and best developed eyes, in order to secure seed which will produce the most vigorous plants. It is further claimed that where tops are universally used as seed that a degeneracy of the cane will follow, since the latter is always reproduced with those parts of the cane where the juices are the poorest in nourishment [sugar] and the eyes the most imperfectly developed. Hence it is a practice with some of our planters never to plant fall cane until the polariscope shows at least 10 per cent. sugar in the cane. *Per contra* there are others who claim that the planting of the tops is justifiable from purely scientific reasons, besides the economy involved. They regard the cane planted as "cuttings" rather than true seed, and the eyes as buds to be developed under proper conditions. They say that the florist when he wants to

root new plants, never uses the old or mature wood, but rather the young and succulent portions. Therefore in planting cane the youngest and most succulent portions will secure the best results. Which is right has not yet been decided by science. Experiments in the field have demonstrated that eyes from both the mature and immature parts of the stalk will germinate. But which are the best, i. e. which will insure the best and surest results under the varying conditions of our seasons, soils and rainfall? To determine this question, the following experiments were instituted with a view of continuing them through a series of years in order to eliminate as far as possible all the modifying factors, incident to one year's experiment. Great pains were taken to select healthy stalks of uniform length. These were cut up into short pieces beginning with the green immature top.

PLAT O—CANE—GERMINATION QUESTIONS.

Experiment No. 1—Planted with green tops usually thrown away.
" " 2—2 joints next to top [green.]
" " 3—Next 2 joints [partially green.]
" " 4— " " "
" " 5— " " "
" " 6— " " "
" " 7— " " "
" " 8— " " "
" " 9—2 Butt joints.
" " 10—Upper thirds of the cane.
" " 11—Middle of the cane.
" " 12—Butt of the cane.

This plat was planted in the fall and the subsequent severe winter, with a late unfavorable spring, so prevented germination as to vitiate results. All germinated badly, but No. 3 gave the largest number of sprouts; No. 2 next, with No. 7 third. These experiments have been repeated, with better promises of success.

PHYSIOLOGICAL QUESTIONS.

Influence of Suckers.—A very great diversity of opinion prevails as to influence of suckers, "side shoots," which spring up around the base of the original sprout. This opinion has been based partly upon poorly conducted experiments, and partly upon the erroneous impression which this wrongly used term "sucker" has produced upon the mind. Some think it an abnormal growth, a live parasite preying upon the nutriment of the main stalk and thus depriving the latter temporarily of its vigor, at a time when rapid growth is so desirable, and therefore they should be removed. It has been found on the other hand however, that these suckers, if permitted to grow, reach maturity almost as soon as the parent stalk, is equally as large, and quite as rich in sugar. They also add largely to the crop, and when a thin stand is obtained, the multiplication of suckers rapidly closes the gaps and gives in the end fair yields. Some planters thus ascribe to suckers the greater part of their crop,

and encourage their growth by awaiting for their full development in the spring before proceeding to a vigorous cultivation of their crop. They further claim that the suckers give stubble the next year, while the original or central stalks do not ratoon well, if at all.

All these descrepancies of opinion arise from a misunderstanding and misuse of the term "sucker." The habit usually denominated suckering in cane, is not suckering at all, but a process common to all graminaceous plants and known usually as "tillering." It is a natural means of increase and of preserving its own existence in the battle of life. By this means, grasses and small grains are enabled to occupy the entire ground to the exclusion of other plants, and thus secure increased harvests. This "tillering" is an underground development characteristic of cane and wheat, and springs from underground buds specially prepared for this process. Simultaneous with the development of the sucker is a set of roots of its own, springing directly from it and in no way interfering with the roots of the original plant. The extent of tillering or suckering depends therefore upon the healthy growth of the plant, the fertility of the soil, the weather during early growth, the thickness of the stand, and the time it has to sucker in. Abundant tillering is an evidence of thriftiness and an index to increased root development. The cane however *truly "suckers"* but fortunately such occurrences are rare. By true suekers, is meant, the development of eyes above ground, which produce stalks living at the expense of the parent stalk. This occurs whenever the upward growth of the plant is checked, or the stalk is bent down from any cause, followed by very damp weather etc. This process is very common to some varieties of sorghum after its main stalk has reached maturity. It is also found in oats, which frequently send forth branches from the axils of leaves which bear grain. In both instances the seed unequally ripens. True suckers in cane are therefore very objectionable and should be prevented if possible.

Duplicate experiments were made to test the question of removing the so called suckers, both at the Sugar Experiment Station. and at the State Experiment Station Louisiana State University and A. & M. College at Baton Rouge, La., and with almost identical results.

The following is an account of these experiments:

3 plats were manured and planted and cultivated alike.

On No. 1 the "suckers were removed daily until June 22d.

On No. 2 the "suckers" were removed daily until September 22d.

On No. 3 they were not disturbed. Before giving the results which are decidedly positive, a description of the difficulties encountered, and the effects produced by suckering will be given.

The original cane grew very slowly and seemed to have ex-

pended all of its energy in trying to make "suckers." When one sucker was carefully removed, several would appear in a day or two afterwards. Neither time, removal of suckers, cultivation nor any practice tried could dissuade the plant from its disposition to sucker. On June 22d it was determined to let plat No. 1, which up to that time had been carefully desuckered, to proceed with its suckering at will. In two weeks time, the cane had a thick stand and a wonderful growth. Several of these suckers by actual measurement growing over two feet in vertical height in two weeks.

Plat No. 2 was restrained from suckering till September 22d, at which time it was abandoned, and when the frost struck it there was a vigorous growth of densely crowded young cane about two feet high. This prohibition of "tillering" however, produced *true suckers*. Early in July it was found that the eyes of the cane were developing under the leaf, soon made apparent by a vigorous shoot from the centre of the leaf. These developments took place as fast as the eyes were matured. They were removed as fast as discovered. This process of true suckers continued up to the top of the cane, so that at the end of the season there was scarcely an eye to be found on any stalk in the plat.

This ceaseless attempt at tillering and suckering was also destructive of the sugar in the stalk, as repeated analyses showed never more than 4 per cent sugar in the cane. The results at Baton Rouge on a different soil were the same.

RESULTS OF SUCKERING CANE NOVEMBER 6, 1836.

	YIELD PER ACRE.	ANALYSES OF JUICE.	
	Tons.	Total Solids.	Sugar
No. 1. Desuckered till June 22nd	19.32	13.4 per cent	10. per cent.
No. 2. Desuckered till Sept. 22nd.		Not Worth Harvesting. Still Standing.	
No. 3. All the Suckers Permitted to Grow.	22.62	14.27	10.6 per cent.

From the above it is perfectly plain that the "tillering" [suckering] of cane is a natural process of great benefit, and should be restricted with great care. To what extent and when a too great a tendency to this process should be corrected is a question for the individual planter to decide. Cane planted too thick, in thin soils, in badly broken, or poorly tilled land, and very late in season, tiller but little. The tendency nevertheless exists, bnt root growth is checked and with it the prospects of a crop. Hence the aim should be to attain the healthiest and richest type of the plant, and such is to be found only when the conditions exist for its freest and fullest development of all its parts in a manner devised by nature. This suggests then, care in planting, not to secure too heavy a stand in the

beginning for the fertility of the soil; proper manuring, in quantity, quality, and mode of application; deep plowing in preparation of land, and early cultivation of crop, and shallow culture thereafter to prevent disturbance of increased root growth, early planting with well selected seed, and upon mellow well drained soil. A close attention to the above and the process of suckering can be encouraged with hope of highest results.

Whether the stubble comes only from the suckers, can be possitively determined next year, since these plats will be reserved for that purpose.

VARIETIES OF CANE.

The following is taken from Bulletin No. 3:

Early in the fall planters throughout the State were requested to send to Station a few selected cane of the different varieties grown by them. The object was to test whether, by selection and proper manuring, an improved variety could not be permanently developed. The following have been received:

No.	1.	Selected	red cane, from Ashland plantation, Kenner & Brent.	
"	2.	"	striped Mexican " "	
"	3.	"	white La Pice " "	
"	4.	"	Japanese, from Tchoupitoulas plantation, Soniat Bros.	
"	5.	"	small red, " "	
"	6.	"	striped, " "	
"	7.	"	bastard, " "	
"	8.	"	large red, " "	
"	9.	"	large red and striped, from Station.	
"	10.	"	large red, from Cypremort, St. Mary, J. M. Burguieres.	
"	11.	"	yellow ribbon, Port Hickey, W. S. Slaughter & Bros.	
"	12.	"	red, " "	
"	13.	"	red, from Baton Rouge, S. Shorten.	
"	14.	"	red, from Homestead, Dr. Wm. E. Brickell.	
"	15.	"	ribbon, " "	
"	16.	"	Bourbon, from Cuba, D. D. Colcock.	
"	17.	"	red, from Homestead, Dr. Wm. E. Brickell,	
"	18.	"	red (tops), " "	
"	19.	"	yellow La Pice, from H. A. LeSassier.	

Of these Nos. 6 and 19, failed to germinate. Fresh specimens of No. 19 have been received and planted this fall from Mr. LeSassier.

ANALYSIS OF VARIETIES NOVEMBER 22, 1886.

No. of Expt.	Specific Gravity.	Degrees Baume.	Total Solids.	Cane Sugar.
1	1.0613	8.3	15.	11.4
2	1.0630	8.5	15.4	12.5
3	1.0621	8.4	15.2	12.
*4	1.0531	7.3	13.1	9.4
5	1.0634	8.6	15.5	13.2
6	......	...	....	....
7	1.0643	8.7	15.7	13.
8	1.0604	8.2	14.8	12.1
9	1.0630	8.5	15.4	13.2
10	1.0669	9.	16.3	13.2
11	1.0634	8.6	15.5	12.7
12	1.0643	8.7	15.7	13.
13	1.0652	8.8	15.9	14.2
14	1.0678	9.1	16.5	13.5
15	1.0652	8.8	15.9	14.2
16	1.0634	8.6	15.5	12.8
17	1.0630	8.5	15.4	12.7

These varieties were harvested and planted Nov. 22d, 1886. Three average stalks from each variety were crushed and analysed with results given above. At same time they were critically examined and classified as follows:

Nos. 1, 8, 9, 12, 13 and 14, were unquestionably alike, and were of the purple variety so common in this countrp.

No. 5 was a red cane of medium size. Red stripes of varying thickness on a yellowish brown ground, with some splotches of yellowish green near the nodes.

Nos. 2, 10, 11 and 15, striped cane. Reddish stripes of varying breadth on yellowish green ground. Doubtless all of same variety.

No. 7, Bastard cane. When planted one-half of each joint was red and the other white. The cane harvested on this plat was pure white or striped. Evidently not the product of the cane planted.

Nos. 3 and 16. The one the "Bourbon" cane directly from Cuba. The other the white LaPice from Messrs. Kenner & Brent's Ashland plantation, were so nearly alike that a close examination failed to detect a difference.

No. 17 was a large red cane, distinct in every way from the purple vartety. Color of different shades but no stripes.

Through the courtesy of Commissioner Norman J. Colman, of Washington, the United States Consuls in the various sugar growing countries, have been requested to send samples of all obtainable varieties of sugar cane to this Station. It is thus hoped that a large number may be secured and ultimately varieties better adapted to Louisiana obtained, besides affording an opportunity of studying and classifying the various kinds now cultivated.

TRASHING CANE.

It is a practice in some countries to have the leaves of the cane as they mature, removed. The process is called trashing. In the early part of September, a portion of Experiments Nos. 2, 12, 13, 15, and 16, were selected for testing this on a small scale. Accordingly as fast as the leaves matured they were removed. At harvest time Nov. 22d, selected samples were analysed with following results:

ANALYSIS OF TRASHED CANE.

No. of Expt.	Specific Gravity.	Degrees Baume.	Total Solids.	Cane Sugar.
2	1.0660	8.9	16.1	14.
12	1.0652	8.8	15.9	13.8
13	1.0739	0.9	17.9	15.5
15	1.0660	8.9	16.1	14.
16	1.0678	9.1	16.5	15.7

A comparison with table on page —— will show decided gains in every instance by trashing except No. 15. Even here the total solids are increased—but the sugar is slightly diminished.

MANURIAL REQUIREMENTS.

It is highly important to discover a fertilizer that will give a maximum tonnage with maximum sugar content with cane upon the soils of Louisiana. The latter are now under investigation by the Station, and it is hoped that in a few years they may be accurately classified and manures adapted to each specifically determined. The station has cane growing, beginning at the levee and running back six and a half acres. The soil near the levee is a mixture of what is usually denominated sandy and black lands. It gradually shades into the latter, till at a depth of two acres, it is a veritable "terre gras." Three analyses of this soil, taken at different distances from the river, were made last summer, and are herewith appended.

ANALYSES OF SOILS OF SUGAR EXPEBIMENT STATION.

	Plat No. 16—Next to River—Mixed Soil.	Plat No. 2—Group 1—200 y'ds from River—Black Soil.	Plat No. 2—Group 7—400 y'ds from River—Black Soil.
Insoluble Matter...	79.37	77.52	74.21
Soluble Silica......	.01	.01	.01
Potash............	.31	.20	.13
Soda..............	.48	.19	.23
Lime..............	.46	.57	.52
Magnesia..........	.04	.03	.03
Peroxide of Iron, Alumina.........	6.37	6.74	6.63
Phosphoric Acid....	.12	.11	.10
Sulphuric Acid.....	.04	.04	.03
Organic Matter....	10.50	14.50	16.24
Carbonic Acid...., Chlorine and Loss	2.30	.09	1.87
	100.00	100.00	100.00

An examination of above shows that so far as the mineral ingredients are concerned, that these soils are almost identical. The organic matter increases as we go from the river. These soils are deficient in physical qualities rather than chemical ingredients. The former limiting the available supply of the latter, and requiring the application of manures for large crops. To test the kinds and quantities required, has been the object of the series of experiments which follow. It should be remembered that any physical amendment to a soil, such as underdraining, deep plowing, subsoiling, etc., is in itself a manure, since it enables the roots of a plant to forage over an increased area and thus obtain larger supplies of available food. Unfortunately for the Station, the seed used in its experiments were seriously injured by being badly put away. Accordingly no stands were obtained anywhere on the Station. Through hot beds prepared on the Station and the liberality of our neighbors, Messrs. Soniat Bros., this defect was partially repaired. In May all the gaps were filled up with transplanted cane, placed six inches apart, or two plants to the running foot. Thus a uniform but by no means a large stand was obtained late in May, and in reading the results given, due allowances must be made for these deficiencies. Had twice the stand been obtained early in the season, the results would probably have been very much larger.

Of the plats given in Bulletin No. 3, Nos. 1 and 9, on account of very defective stands were abandoned and the cane transplanted to fill up vacancies in other plats. Nos. 2, 7, 8 and parts of 4 and 5, were successfully carried through the sugar house. Nos. 14 and 16 were used for seed in fall planting, while Nos. 6 and parts of 4 and 5 have been windrowed for seed and for the mill, to be worked up at various times during the winter.

Samples of cane from all of these plats huve however been several times analyzed and resnlts with dates of analyses will be given under proper heads.

PLAT NUMBER 2.—CANE.

Ground prepared with four horse plow. Harrowed and manures put out and cane planted Oct. 19th, 1885. Nos. 3, 8, 13, 18, 23, 28, 33 and 38, were not manured at time of planting. They were manured May 24th. Ground was hard and cloddy when planted. Hence much of the seed dryrotted during the drouth which prevailed immediately after. Having failed to secure a stand from the seed, this plat together with all the others was transplanted with cane from prepared hot beds and from our neighbors field. The stalks of cane of all sizes from a few inches to a foot or more in height with the mother stalk attached were very very successfully transplanted, 6 inches apart. Thus a stand of one running stalk every six inches was obtained, which, though uniform, was far from being enough. The manures used are appended with tonnage and sugar content.

RESULTS OF PLAT 2.

No. of Expt.	Manures Used Per Acre.	Tons Per Acre	Total Solids	Cane Sugar	When worked in Sugar House.
1	200 lbs. cotton seed meal 100 " acid phosphate	16.30	12.6	10.7	Oct. 29,
2	333 lbs cotton seed meal 167 " acid phosphate	17.52	12.9	10.5	Nov. 1.
*3	140 lbs sulphate ammonia 120 " dried blood 200 " cotton seed meal 460 " acid phosphate 80 " muriate acid	21.22	12.6	10.6	Nov. 1.
4	466 lbs cotton seed meal 234 " acid phosphate	22.62	14.2	10.6	Nov. 6.
5	600 " cotton seed meal 300 " acid phosphate	23.46	13.	11.	Oct. 29.
6	600 " cotton seed meal 300 " acid phosphate 300 " kainite	23.29	12.9	10.4	Nov. 2.
7	600 " cotton seed meal	18.64	12.4	9.6	Nov. 3.
*8	260 " sulphate ammonia 460 " acid phosphate 80 " muriate acid	19.02	13.6	10.8	Nov. 3.
9	300 " acid phosphate 300 " kainite	15.00	12.9	10.1	Nov. 4.
10	300 " kainite	14.92	14.0	10.7	Nov. 4.
11	200 " cotton seed meal 100 " floats	12.54	14.4	11.8	Nov. 8.
12	333 " cotton seed meal 167 " floats	15.74	13.7	11.2	Nov. 8.
*13	466 " cotton seed meal 234 " floats	17.34	14.4	12.	Nov. 9.
14	466 " cotton seed meal 334 " floats	18.32	13.9	11.1	Nov. 9.
15	600 " cotton seed meal 300 " floats	20.20	13.7	12.	Nov. 10.
16	600 " cotton seed meal 300 " floats 300 " kainite	19.10	15.4	11.6	Nov. 13.
17	600 " cotton seed meal 300 " floats 300 " kainite 200 " gypsum	18.06	14.5	11.	Nov. 13.
18	Nothing	14.26	15.4	12.1	Nov. 15.
19	600 lbs cotton seed meal 300 " floats 300 " cotton hull ashes	16.36	15.1	12.4	Nov. 15.
20	300 " tankage	16.40	14.5	12.5	Nov. 16.
21	450 " "	16.40	15.7	13.5	Nov. 16.
22	700 " "	16.60	14.3	11.6	Nov. 16.
*23	900 " "	17.90	15.5	11.9	Nov. 17.
24	900 " "	15.88	15.5	12.1	Nov. 17.
25	900 " " 300 " kainite	18.42	16.1	12.5	Nov. 18.
26	900 " tankage 300 " kainite 200 " gypsum	19.32	16.3	13.	Nov. 18.
27	900 " tankage 300 " cotton hull ashes	16.40	15.7	12.4	Nov. 19.
*28	900 " rankage 200 " gypsum	17.82	15.5	12.2	Nov. 20.
29	1700 lbs cotton seed, raw	16.04	14.8	11.2	Nov. 21.

No. of Expt.	Manures Used Per Acre.	Tons Per Acre	Total Solids	Cane Sugar	When worked in Sugar House.
30	1700 " cotton seed, raw 300 " acid phosphats	16.40	15.7	12.8	Nov. 22.
31	1700 " cotton seed, raw 300 " acid phosphate ...... 300 " kainite	17 00	16.	13.6	Nov. 22.
32	1700 " cotton seed, raw 300 " cotton hull ashes	16.84	14.6	11.1	Nov. 23.
*33	466 " cotton seed meal 234 " acid phosphte	17.24	15.	11.8	Nov. 23.
34	1700 " cotton seed, raw 300 " floats	15.56	15.4	11.9	Nov. 24.
35	1700 " cotton seed, raw 300 " floats ...... 200 " gypsum	18.50	14.8	11.	Nov. 24.
36	10 tons stable manure †	12.00	14.0	10.8	Nov. 25.
37	10 tons stable manure † 300 lbs acid phosphate	13.68	15.	11.	Nov. 25.
38	Nothing......................	8.72	15.	11.4	Nov. 25.
39	10 tons stable manure 300 lbs acid phosphate ...... 300 " kainite	13.72	15.4	11.5	Nov. 25.
40	10 tons stable manure † 300 lbs floats	13.08	16.1	13.	Nov. 25.

*Manures applied to these plates on 24th May. Rest October 19th.

†These experiments were in the rear of the plat, and were cepredated upon by freedmen.

By examining above it is found that a mixture of cotton seed meal and acid phosphate has produced the highest results —that kainite has added nothing to the crop—that the addition of acid phosphate to the cotton seed meal has greatly increased the quantity and quality of the crop, and that the application of manures in the fall has been as satisfactory as spring application of the same manures. Several other suggestions might be accepted from these experiments, but it is perhaps better to await another year's development before doing so.

PHOSPHORIC ACID MANURES—PLAT 7.

The object of this plat is to test the form and quantity of phosphoric acid best adapted to cane; using it in a soluble form in dissolved bone black and acid phosphate, in a precipitated form as precipitated bone black and precipitated acid phosphate, and in an insaluble form as bone dust and finely ground Charleston phosphate, called "fioats"; also in the natural form of Orchilla guano. This plat was planted February 20th and 22d and gaps filled with transplanted cane May 23d and 25th.

GROUP 1—DISSOLVED BONE BLACK.

(Phosphoric Acid.)

Experiment No. 1 { 18 lbs. cotton seed meal.
18 lbs. kainite.
*Basal mixture.

" " 2 { Basal mixture.
6 lbs. dissolved bone black, equal to $\frac{1}{3}$ ration.

" " —Nothing.

" " 4 { Basal mixture.
12 lbs dissolved bone black, equal to $\frac{2}{3}$ ration.

" " 5 { Basal mixture.
18 lbs. dissolved bone black, equal to full ration.

GROUP 2—ACID PHOSPHATE.

Experiment No. 6—Basal mixture.

" " 7 { Basal mixture.
6 lbs. acid phosphate.

" " 8—Nothing.

" " 9 { Basal mixture.
12 lbs. acid phosphate.

" " 10 { Basal mixture.
18 lbs. acid phosphate.

GROUP 3—PRECIPITATED BONE BLACK.

(Precipitated Phosphoric Acid.)

Experiment No. 11—Basal mixture.

" " 12 { Basal mixture.
6 lbs. precipitated bone black, equal to $\frac{1}{3}$ ration.

" " 13—Nothing.

" " 14 { Basal mixture.
12 lbs. precipitated bone black, equal to $\frac{2}{3}$ ration.

" " 15 { Basal mixture.
18 lbs. precipitated bone black, equal to full ration.

GROUP 4—PRECIPITATED ACID PHOSPHATE.

(Precipitated Phosphoric Acid.

Experiment No. 16—Basal mixture.

" " 17 { Basal mixture.
6 lbs. precipitated acid phosphate, equal to $\frac{1}{3}$ ration

" " 18—Nothing.

" " 19 { Basal mixture.
12 lbs. precipitated acid phos. equal to $\frac{2}{3}$ ration.

" " 20 { Basal mixture.
18 lbs. precipitated acid phos. equal to full ration.

GROUP 5—BONE DUST.

(Insoluble Phosphoric Acid.)

Experiment Eo. 25—Basal mixture.

" " 22 { Basal mixture.
6 lbs. bone dust, equal to $\frac{1}{3}$ ration.

" " 23—Nothing.

" " 24 { Basal mixture.
12 lbs. bone dust, equal to $\frac{2}{3}$ ration.

" " 25 { Basil mixture.
18 lbs. bone dust, equal to full ration.

GROUP 6—ROCK PHOSPHATE.

(Insolubie Phosphoric Acid.

" " 26—Basal mixture.

" " 27 { Basal mixture. 6 lbs. floats, equal to ⅓ ration.

" " 28—Nothing.

" " 29 { Basal mixture. 12 lbs. floats, equal to ⅔ ration.

" " 30 { Basal mixture. 18 lbs. floats, equal to full ration.

GROUP 7—NATURAL PHOSPHATE.

Experiment No. 31—Basal mixture.

" " 32 { Basal mixture. 6 lbs. Orchilla gbano, equal to ⅓ ration.

" " 33—Nothing.

" " 34 { Basal mixture. 12 lbs. Orchiila guano, equal to ⅔ ration.

" " 35 { Basil mixture. 18 lbs. Orchilla guano, equal to full ration.

*Basal mixture in this group means 18 lbs. cotton seed meal and 18 lbs. kainite.

RESULTS OF EXPERIMENTS PLAT NO. 7.

No of Expt.	Tonnage Per Acre.	Total Solids.	Cane Sugar.	When Ground in Sugar House
1	15.75	15.7	12.7	December 1st.
2	17.76	15.9	13.2	November 25th.
3	14.06	15.5	12.1	December 2nd.
4	16.78	15.4	11.8	November 25th.
5	18.75	15.5	12.3	November 25th.
6	15.40	15.5	12.5	December 1st.
7	18.48	15.4	12.8	November 30th.
8	14.34	15.4	11.6	December 2nd.
9	16.34	15.2	12.4	November 30th.
10	16.42	14.8	11.5	November 30th.
11	12.94	15.7	12.7	December 1st.
12	15.41	15.5	12.5	November 30th.
13	12.03	15.4	12.1	December 2nd.
14	13.73	15.5	12.5	November 30th.
15	12.23	15.2	12.3	November 30th.
16	12.45	16.1	12.7	December 6th.
17	15.93	.15.4	12 1	December 1st.
18	12.30	15.7	12.8	December 7th.
19	13.88	15.	11.3	December 1st.
20	14.18	15.2	11.6	December 1st.
21	11.29	16.3	13.8	December 6th.
22	13.58	15.9	12.5	December 2nd.
23	11.96	15.5	12.7	December 7th.
24	12.19	15.9	12.5	December 2nd.
25	12.90	16.1	13.8	December 2nd.
26	11.51	16.3	13.4	December 6th.
27	12.00	16.1	13.1	December 3d.
28	10.95	15.9	12.9	December 7th.
29	11.85	15.5	12.4	December 7th.
30	14.06	15.5	12.4	December 7th.
31	9.34	15.7	13.1	December 6th.
32	10.16	15.9	12.9	December 3d
33	8.24	15.2	12.	December 7th.
34	8.44	15.7	13.	December 3d.
35	10.65	13.7	11.3	December 3d.

By comparing in each group the "basal mixture" with the "basal mixture mixed with the phosphate' we obtain the benefit derived from the phosphoric acid, and by comparing them with the unfertilized experiments, we obtain the increase due to the manure. It must be noted however, that the "nothings" occupied the center of the plat and from their location were naturally better than the rest of the plat. This natural advantage was recognized before planting, but no better arrangement could be devised.

Taking each group up separately we have for Group 1 Dissolved Bone Black:

GROUP 1.

Yield of "Nothing" per acre	14.06 tons.
" " Basal mixture	15.75 "
" " $\frac{1}{3}$ Ration Dissolved Bone Black	17.76 "
" " $\frac{2}{3}$ " " " "	16.78 "
" " 3-3 " " " "	18.75 "
Increase due to $\frac{1}{3}$ ration over Basal Mixture	2.01 "
" " " $\frac{2}{3}$ " " " "	1.03 "
" " " 3-3 " " " "	3.00 "
Increase of Basal Mixture over nothing	1.69 "
" " ration Dissolved Bone Black over nothing	3.70 "
" " $\frac{2}{3}$ " " " " " "	2.72 "
" " 3-3 " " " " " "	4.69 "

COMPARING EACH GROUP IN THIS WAY WE HAVE GROUP 2.

Increase Basal Mixture over nothing	1.06 tons.
" $\frac{1}{3}$ ration Acid Phosphate over nothing	4.14 "
" $\frac{2}{3}$ " " " " "	2.00 "
" 3-3 " " " " "	2.08 "

GROUP 3.

Increase Basal Mixture over nothing	.91 tons.
" $\frac{1}{3}$ ration prec. Dissolved Bone Black	3.38 "
" $\frac{2}{3}$ " " " " "	1.70 "
" 3-3 " " " " "	.20 "

GROUP 4.

Increase of Basal Mixture over nothing	.15 tons.
" $\frac{1}{3}$ ration Pres. Acid Phosphate	3.63 "
" $\frac{2}{3}$ " " " "	1.58 "
" 3-3 " " " "	.94 "

GROUP 5.

Increase of Basal Mixture over nothing	.67 tons.
" $\frac{1}{3}$ ration Bone Meal over nothing	1.62 "
" $\frac{2}{3}$ " " " " "	.23 "
" 3-3 " " " " "	.94 "

GROUP 6.

Increase of Basal Mixture over nothing	.56 tons.
" $\frac{1}{3}$ ration Floats over nothing	1.05 "
" $\frac{2}{3}$ " " " "	.90 "
" 3-3 " " " "	3.01 "

GROUP 7.

Increase of Basal Mixture over nothing	1.10	tons.
" ⅓ ration Orchilla over nothing	1.92	"
" ⅔ " " " "	.20	"
" 3-3 " " " "	2.41	"

AGGREGATING AND COMPARING RESULTS WE HAVE.

Group 1.—Total increase of Dissolved bone black over nothing	11.11	tons.
" 2.— " " " Acid Phosphate " "	8.22	"
" 3.— " " " Prec. Dissolved Bone " "	5.28	"
" 4.— " " " Prec. Acid Phosphate " "	7.09	"
" 5.— " " " Bone Meal " "	2.89	"
" 6.— " " " Floats " "	4.96	"
" 7.— " " " Orchilla " "	4.53	"

It is evident from above that phosphoric acid gives an increase in yield, but that this yield is not in proportion to quantity applied. Large quantities are therefore useless and expensive if we may judge from above results. These experiments are not very decisive as to the form of phosphoric acid desired. While the soluble forms are ahead and the precepited next, the gains are too small to be pronounced decided, and yet enough to commend these forms to our preference.

POTASSIC MANURES—PLAT 8.

This plat was designed to test the form and quantity of potash best adapted to cane, using the muriate, sulphate, nitrate, carbonate and kainite. The ashes of cotton hulls have been used elsewhere in other plats. For potatoes and sugar beets the sulphate is preferred to the muriate, the latter injuring the sugar in beets and the starch in potatoes. This plat was planted March 15, and gaps filled with transplanted cane May 21.

GROUP 1—FORMS OF POTASH ALONE.

Experiment No. 1—4 lbs. muriate of potash.
" " 2—16 lbs. kainite.
" " 3—Nothing.
" " 4—4 lbs. sulphate potash.
" " 5—2⅔ lbs. carbonate potash.

GROUP 2—MURIATE POTASH.

Experiment No. 6 { 18 lbs. cotton seed meal. 15 lbs. acid phosphate. *Meal phosphate.
" " 7 { Meal phosphate. 4 lbs. muriate potash, equal to ⅓ ration.
" " 8—Nothing.
" " 9 { Meal phosphate. 8 lbs. muriate potash, equal to ⅔ ration.
" " 10 { Meal phosphate. 12 lbs. muriate potash, equal to full ration.

GROUP 3—KAINITE.

Experiment No. 11—Meal phosphate.
" " 12 { Meal phosphate. 16 lbs. kainite, equal to ⅓ ration.
" " 13—Nothing.
" " 14 { Meal phosphate. 32 lbs. kainite equal to ⅔ ration.
" " 15 { Meal phosphate. 48 lbs. kainite, equal to full ration.

GROUP 4—SULPHATE POTASH.

Experiment No. 16—Meal phosphate.
" " 17 { Meal phosphate. 4 lbs. sulphate potash, equal to ⅓ ration.
" " 18—Nothing.
" " 19 { Meal phosphate. 8 lbs. sulphate potash, equal to ⅔ ration.
" " 20 { Meal phosphate. 12 lbs. sulphate potash, equal to full ration.

GROUP 5—CARBONATE POTASH.

Experiment No. 21—Meal phosphate.
" " 22 { Meal phosphate. 2¾ lbs. carbonate potash; equal to ⅓ ration.
" " 23—Nothing.
" " 24 { Meal phosphate. 5½ lbs. carbonate potash, equal to ⅔ ration.
" " 25 { Meal phosphate. 8¼ lbs. carbonate potash, equal to full ration.

GROUP 6—NITRATE POTASH.

Experiment No. 26—Meal phosphate.
" " 27 { 9 lbs. cotton seed meal. 15 lbs. acid phosphate. 4½ lbs. nitrate Potash, equal to ⅓ ration.
" " 28—Nothing.
" " 29 { 9 lbs. cotton seed meal. 15 lbs. acid phosphate. 9 lbs. nitrate Potash equal to ⅔ ration.
" " 30 { 9 lbs. cotton seed meal. 15 lbs. acid phosphate. 13½ lbs. nitrate Potash, equal te full ration.

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*Meal phosphate in this plat means 18 lbs. cotton seed meal and 15 lbs. acid phosphate.

Group No. 1 and Experiments No. 10, 15, 20, 25 and 30, have not yet been worked up. They have been put away in different ways to be worked up during the winter.

No. of Expt.	Tonnage Per Acre.	Total Solids.	Cane Sugar.	When Worked in the Mill.
6	17.27	14.6 p.c.	14. p. c.	December 8th.
7	20.74	15.9	12.9	December 10th.
8	22.76	15.5	12.4	December 9th.
9	22.46	15.9	13.	December 10th.
11	13.54	16.6	13.8	December 8th.
12	19.35	15.9	13.	December 10th.
13	22.95	15.4	12.4	Docember 9th.
14	22.57	15.7	12.6	December 10th.
16	13.20	16.2	13.6	December 8th.
17	15.26	15.8	13.1	December 13th.
18	13.72	15.	11.7	December 9th.
19	13.20	15.7	12.9	Decomber 13th.
21	7.42	15.	11.8	December 8th.
22	11.58	14.6	10.7	December 13th.
23	10.08	14.4	11.2	December 9th.
24	9.15	14.5	10.5	December 13th.
26	7.76	15.4	11.8	December 8th.
27	10.20	14.8	11.4	December 14th.
28	12.00	14.9	11.1	December 9th.
29	13.58	13.9	10.5	December 14th.

The results of these experiments are highly discordant and very unsatisfactory. The largest yields are the unfertilized plats. A portion of this plat was in corn and peas previous to these experiments, and was in excellent order, and ploughed well. The rest was in stubble, The unfertilized experiments occupied the centre of the plat, came up better and grew off faster than elsewhere. The manner in which the plat had been previously frequently ploughed, had caused a ridge in the centre of the plat. Hence this ridge was from its position the best drained dart of the plat. Again this plat occupied the extreme western part of the Station and was the last cane cut. Hence in spite of our efforts to prevent them, depredations by the freedmen were frequent and severe. Groups No. 8, 5 and 6, were never equal to the others, and it is believed that they were entirely within the stubble of the previous year. Group No. 6 was the last cane planted on the station, much later than the rest, and never caught up. Group No. 5 never did well. In fact during the season whenever carbonate of potash; either pure or in the ashes of cotton hulls, was used, a diminished growth and sickly hue were plainly visible in the cane. The juices from these plats as well as those from Plat 7, have been analysed carefully as to their ash content, to determine what effect increased quantities of mineral manures may have on the cane. The centrifugal molasses ultimately coming from the sugar obtained from each of these experiments has been analysed to determine the mineral matter present, preventing crystalization. Results of these analyses will be included in the Bulletin on the Sugar House.

TILE DRAINING.

Last fall the Station had several acres tiled drained. One plat was selected one acre wide and four acres deep, and one-half of it was tiled, while the other was not. The object was to determine by duplicate experiments the effect of tiles on this soil. The tiles in this plat are laid four feet deep, and at a uniform distance of 20 feet, using tile of sizes from 2½ to 4 inches in diameter. Plats 4 and 5 are divided by an imaginary line, the latter tiled and the former not. The same experiments were made on each. These plats were planted with stubble, transplanted from an abandoned field of our neighbors, Soniat Bros., on the last of May. The first group only was harvested, the rest being windrowed for seed.

RESULTS OF TILED AND UNTILED SOIL—PLATS 4 AND 5.

		Tons Per Acre.	Total Solids.	Sugar.	When Ground.
Expt. No. 1	Untiled	6.72	14.8	12.1	December 7th.
" " 1	Tiled	12.08	15.2	12.4	" "
" " 2	Untiled	9.62	14.2	10.9	" "
" " 2	Tiled	14.80	14.8	11.6	" "
" " 3	Unfertilized	7.64	13.7	10.6	" "

The manure used on No. 1, was a mixture cotton seed meal, acid phosphate and kainite, and on No. 2, only cotton seed meal and acid phosphate.

No 2 tiled, was next to the main canal into which the tiles emptied, No. 1 tiled next, then unfertilized tiled plat, then No. 2 untiled, and last and furthest from the tiles was No. 1 untiled. This plat was originally the blackest and stiffest piece of land on the place, and was, on this account, selected for tiling. Its improvement from tiling is very perceptible, in appearance, in plowing and in the growth of cane. During the summer when the drouth checked the growth of all the other plats on the Station, the tiled drained cane continued to grow, and it was the last to be killed by the frost in the fall- It is too early yet to recount the benefits of tile drainage on Louisiana soil. Suffice to say that it is giving promise of great success and if one-half of the benefits claimed for it, are realized, it will be a great boon to sugar growers.

The following are the manures used on each plat:

PLATS 4 AND 5.

Experiment No. 1 { 25 lbs. cotton seed meal.
25 lbs. acid phosphate.
25 lbs. kainite.

" " 2 { 25 lbs. cotton seed meal.
25 lbs. acid phosphate.

" " 3—Nothing.

" " 4 { 25 lbs. cotton seed meal.
25 lbs. Orchilla phosphate.
25 lbs. kainite.

" " 5 { 25 lbs. cotton seed meal.
25 lbs. Orchilla Phosphate. }
" " 6—Nothing.
" " 7 { 25 lbs. cotton seed meal.
25 lbs. bone dust.
25 lbs. kainite. }
" " 8 { 25 lbs. cotton seed meal.
25 lbs. bone dust. }
" " 9—Nothing.
" " 10 { 25 lbs. cotton seed meal.
25 lbs. floats.
25 lbs. kainite. }
" " 11 { 25 lbs. cotton seed meal.
25 lbs. floats. }
" " 12—Nothing.
" " 13 { 25 lbs. cotton seed meal.
25 lbs. ashes cotton hulls.
25 lbs. kainite. }
" " 14 { 25 lbs. cotton seed meal.
25 lbs. ashes cotton hulls. }
" " 15—Nothing.
" " 16—25 lbs. cotton seed meal.
" " 17—25 lbs. acid phosphate.
" " 18—25 lbs. kainite.

These plats were analysed three times during the season and results are here given.

ANALYSIS OF CANE FROM PLATS FOUR AND FIVE—TILED AND UNTILED.

No. of Expt.	October 25th.				December 2nd.				December 7th.			
	Untiled.		Tiled.		Untiled.		Tiled.		Untiled.		Tiled.	
	Total Solids	Cane Sugar	Total Solids	Cane Sugar	Total Solids	Cane Sugar	Total Solids	Cane Sugar	Total Solids	Cane Sugar	Total Solids	Cane Sugar
1	13.7	9.7	13.4	10.5	.....	....	.....	....	14.8	12.1	15.2	2.4
2	13.2	8.9	14.6	11.3	.....	...	.....	....	14.2	10.9	14.8	11.6
3	....	......	13.9	10.	....	....	.....	....	.....	....	13.7	10.6
4	14.8	11.3	14.3	11.4	13.9	11.6	12.8	11.4	.....	....	....	....
5	14.1	11.4	13.2	10.0	16.8	15.	15.4	13.	.....	....	....	....
6	....	......	12.8	9.1	.....	....	14.8	12.7	.....	....	....	....
7	14.8	11.5	14.4	11.1	14.6	12.5	.....	....	.....	....	....	....
8	13.2	9.	14.8	11.7	.....	....	15.7	13.4	.....	....	....	....
9	....	......	15.4	13.	.....	....	.....	....	.....	....	....	....
10	14.6	11.7	15.8	12.6	15.4	13.	14.6	12.5	.....	....	....	....
11	14.4	11.3	15.2	11.3	14.6	12.5	17.	15.3	.....	....	....	....
12	....	......	14.8	11.	.....	....	14.6	12.5	.....	....	....	....
13	13.7	9.5	14.3	11.	.....	....	13.9	11.6	.....	....	....	....
14	15.2	10.9	15.5	13.	15.4	13.	13.	11.2	.....	....	....	....
15	....	......	15.	11.7	.....	....	15.4	13.	.....	....	....	....
16	14. 8	10.8	12.3	8.6	16.3	14.8	14.8	12.7	.....	....	....	....
17	13.9	10.7	14.5	11.3	14.8	12.7	.....	....	.....	....	....	....
18	13.9	10.1	14.8	11.9	16.3	14.8	14.1	11.9	.....	....	....	....

The effects of the tiles were far more apparent in the size of the cane than in the purity of the juice.

NITROGEN MANURES—PLAT 6.

This plat is also tiled drained, the tiles running east and west, while the different forms of nitrogen were applied north and south, so that whatever leeching might occur from each nitrogen group could be caught and analysed. This, to date, has been four times successfully accomplished, results of which will constitute the matter of a separate bulletin.

In these experiments such quantities of each form is taken as to represent equal amounts of nitrogen, and these are taken in one-third, two-third and full rations. Our object is to test the best form and quantity of nitrogen for cane, as well as to test the other question of loss of these manures by leaching. This plat was planted March 11. It was windrowed for seed and the analysis given below are of samples selected from each plat. This plat was not transplanted and the gaps vitiated the tonnage and hence it was used for seed.

RESUL T OF ANLYSIS OF SAMPLES—PLAT 6.

Manures Used.

GROUP 1—FORMS OF NITROGEN ALONE.

Experiment No. 1—5⅝lbs. nitrate soda.
Experiment No. 2—3 lbs. sulphate of ammonia.
" " 3—Nothing.
" " 4—7½ lbs. dried blood.
" " 5—12 lbs. cotton seed meal.

GROUP 2—NITRATE OF SODA.

" " 6 { 15 lbs. acid phosphate. 4 lbs. muriate potash. *Mixed minerals.
" " 7 { Mixed minerals. 5 lbs. nitrate soda, equal to ⅓ ration.
" " 8—Nothing.
" " 9 { Mixed minerals. 10 lbs. nitrate soda, equal to ⅔ ration.
" " 10 { Mixed minerals. 15 lbs. nitrate soda, equal to full ration.

GROUP 3—SULPHATE OF AMMONIA.

Experiment No. 11—Mixed minerals.
" " 12 { Mixed minerals. 3¾ lbs. sulphate of ammonia, equal to ⅓ ration.
" " 13—Nothing.
" " 14 { Mixed minerals. 7½ lbs. Sulphate of Ammonia, equal to ⅔ ration.
" " 15 { Mixed minerals. 11¼ lbs. sulphate of ammonia, equal to full ration.

GROUP 4—DRIED BLOOD.

Experiment No. 16—Mixed minerals.
" " 17 { Mixed minerals. 7½ lbs dried blood, equal to ⅓ ration.
" " 18—Nothing.
" " 19 { Mixed minerals. 15 lbs. dried blood, equal to ⅔ ration.
" " 20 { Mixed minerals. 22½ lbs. dried blood, equal to full ration.

GROUP 5—COTTON SEED MEAL.

Experiment No 21—Mixed minerals.
" " 22 { Mixed minerals. 12 lbs cotton seed meal, equal to ⅓ ration.
" " 23—Nothing.
" " 24 { Mixed minerals. 24 lbs. cotton seed meal, equal to ⅔ ration.
" " 25 { Mixed minerals. 36 lbs. cotton seed meal, equal to full ration.

GROUP 6—FISH SCRAP.

Experiment No 26—Mixed minerals.
" " 27 { Mixed minerals. 10 lbs. dried fish, equal to ⅓ ration.
" " 28—Nothing.
" " 29 { Mixed minerals. 20 lbs. dried fish, equal to ⅔ ration.
" " 30 { Mixed minerals. 30 lbs. dried fish, equal to full ration.

G OUP 7—MIXED NITROGEN.

Experiment No 31—Mixed minerals.
" " 32 { Mixed minerals. 1⅝ lbs. nitrate soda. 1¼ lbs. sulphate ammonia. 4 lbs. cotton seed meal. } equal to ⅓ ration. Mixed nitrogen.
" " 33—Nothing.
" " 34 { Mixed minerals. 3¼ lbs. nitrate soda. 2½ lbs, sulphate ammonia 8 lbs. cotton seed meal. } equal to ⅔ ration
" " 35 { Mixed minerals. 5 lbs. nitrate soda, 3¾ lbs. sulphate ammonia. 12 lbs. cotton seed meal. } equal to full ration.

GROUP 8—FORMS OF NITROGEN ALONE.

" " 36—Fish scrap.
" " 37—Fish scrap.
" " 38—Nothing.
" " 39 Mixed Nitrogen.

	Total Solids	Cane Sugar
1	16.1	13.
2	16.8	14.7
3	16.6	14.8
4	....	....
5	16.1	13.
6	....	....
7	....	....
8	14.5	11.4
9	14.5	11.4
10	15.9	13.
11	15.7	12.9
12	16.1	13.4
13	16.1	13.2
14	15.7	12.9
15	15.7	12.9
16	15.7	12.9
17	16.8	14.
18	15.7	13.1
19	15.4	12.8
20	16.3	14.
21	15.	12.3
22	15.7	11.2
23	16.6	14.5
24	15.	12.4
25	15.4	12.8
26	15.4	12.8
27	14.8	11.7
28	15.9	13.
29	16.3	13.5
30	....	....
31	16.[illegible]	14.5
32	13.9	11.6
33	13.5	11.5
34	14.3	11.9
35	15.	11.7
36	16.5	14.
37	13.[illegible]	11.7
38	13.9	11.9
39	13.6	11.7

*Mixed minerals in this plat always mean 15 lbs. acid phosphate and 4 lbs, muriate potash.

SANDY LAND EXPERIMENT—PLAT NO. 16.

The following experiments were placed upon sandy land to test the proportions of nitrogen, phosphoric acid and potash adapted to cane on this character of soil. Planted February 19 and 20.

This plat was used for seed in fall planting, but small clumps from each experiment were left standing, and from these the analyses begun in September were continued till late in November.

RESULTS OF ANALYSES OF CANE FROM PLAT NO. 16.

Experiment No.	Fertilizer	Proportions of nitrogen	to phos. acid	to potash
1	32½ lbs cotton seed meal. 12½ lbs kainite. 5 lbs acid phosphate.	3	1	1½
" " 2	30 lbs cotton seed meal. 12½ lbs kainite. 7½ lbs acid phosphate.	2	1	1
" " 3	25 lbs cotton seed meal. 12½ lbs kainite. 12½ acid phosphate.	1	1	1
" " 4	25 lbs cotton seed meal. 25 lbs kainite. 12½ lbs acid phosphate.	1	1	2
" " 5	—Nothing.			
" " 6	—Nothing.			
" " 7	18¾ lbs cotton seed meal. 18¾ lbs acid phosphate. 12½ lbs kainite.	1	2	1
" " 8	18¾ lbs cotton seed meal. 18¾ lbs acid phosphate. 25 lbs kainite.	1	2	2
" " 9	18¾ lbs cotton seed meal. 18¾ lbs acid phosphate.	1	2	0
" " 10	15 lbs cotton seed meal. 22½ lbs acid phosphate. 12½ lbs kainite.	1	3	1½

	Sept. 8th.		Sept. 24th		Oct. 8th.		Nov. 20th.	
	Total Solids	Cane Sugar	Total Solids.	Cane Sugar.	Total Solids	Cane Sugar	Total Solids	Cane Sugar
1	10.8	7.1	9.9	6.	13.7	11.	13.9	10.
2	13.7	10.2	13.7	10.6	12.2	9.2	16.2	13.4
3	12.4	9.2	13.	9.6	13.4	10.5	14.7	12.5
4	10.8	7.	11.3	8.5	12.6	9.8	16.2	13.3
5	11.	7.1	11.9	7.9	13.6	10.5	14.7	11.2
6	12.1	8.2	14.5	12.1	13.4	9.8	15.4	12.9
7	11.	7.2	13.	9.1	13.4	10.2	15.8	13.
8	11.1	7.8	13.2	9.7	12.5	9.3	17.1	14.9
9	11.7	7.6	11.9	8.2	14.1	10.9	....	....
10	11.3	7.2	12.5	8.6	13.	9.9	16.9	15.

STUBBLE CANE—PLAT NO. 14.

This plat is the only piece of first year stubble on the place. It was used to windrow cane in during the past winter, and has been greatly injured. As it was the only opportunity of trying some experiments upon first year stubble, it was deemed expedient to run the risk of the injury. Accordingly it was off-bared, dug, and manures applied March 18th and 19th, and well harrowed in. The object of the experiment is to test manurial requirements of stubble cane upon sandy land.

Experiment	Manures	Nitrogen to phos. acid.	
Experiment No 1	32½ lbs cotton seed meal. 5 lbs acid phosphate.	3	1
" " 2	30 lbs cotton seed meal. 7¼ lbs acid phosphate.	2	1
" " 3	25 lbs cotton seed meal. 12½ lbs acid phosphate.	1	1
4	Nothing.		
" " 5	18¾ lbs cotton seed meal. 18¾ lbs acid phosphate. 4 lbs muriate potash.	1	2
" " 6	18¾ lbs cotton seed meal. 1¾ lbs acid phosphates.	1	2
" " 7	15 lbs cotton seed meal. 22½ lbs acid phosphate.	1	3
" " 8	5 lbs nitrate soda. 7 lbs sulphate ammonia 6 lbs dried blood. 28 lbs acid phosphate. 4 lbs muriate potash.	Formula recommended for cane stubble by Agricultural Station at St. Denis.	
" " 9	14 lbs nitrate potash. 32½ lbs acid phosphate. 21½ lbs gypsum.	Formula recommended for Stubble cane by Geo. Ville, of France.	
10	30 lbs tankage.		
" " 11	30 lbs tankage. 20 lbs ashes cottan seed hulls.		
" " 12	15 bushels compost, (see page 19 Bulletin No. 2.)		
" " 13	50 lbs Sterns' ammoniated dissolved bone.		
" " 14	50 lbs Sterns' sugar goods.		
" " 15	50 lbs Stono guano.		
" " 16	50 lbs Studniczka's cane grower.		
" " 17	50 lbs Rogers' sugar goods.		
" " 18	50 lbs Foster's formula.		
" " 19	50 lbs Mapes' potato manure.		
" " 20	50 lbs Mapes vine and fruit manure,		
" " 21	Nothing.		
" " 22	50 lbs Soluble Pacific guano.		
" " 23	50 lbs Planters cane fertilizer.		

The Pacific sugar goods reached here too late to be put on stubble.

This plat has been windrowed for seed, but small clumps on each plat were left standing, and from these the analyses began in October have been continued. The results of analyses are given.

RESULTS OF ANALYSIS OF CANE, PLAT 14.

	Oct. 2nd.		Oct. 25th.		Nov. 25th.	
No. of Exp't.	Total Solids	Cane Sugar.	Total Solids.	Cane Sugar	Total Solids	Cane Sugar.
1	13.8	8.4	15.	12.5	16.1	13.4
2	13.8	8.8	13.2	9.9	14.8	12.8
3	12.8	8.8	14.6	11.6	14.3	11.2
4	13.7	10.2	15.9	13.3	14.6	12.
5	13.9	9.9	13.6	9.9	14.3	10.9
6	13.2	9.1	15.2	13.	14.3	11.6
7	11.9	7.1	13.7	11.5	16.1	14.2
8	13.4	9.3	14.3	11.8	16.5	14.5
9	13.	8.7	13.	9.7	15.4	13.
10	13.7	9.8	14.3	10.4	16.6	14.6
11	11.9	7.0	12.8	8.6	14.8	11.9
12	13.2	9.9	14.8	11.8	13.2	10.9
13	15.3	11.8	15.	12.8	13.	12.8
14	13.7	9.8	13.6	11.	13.7	10.
15	13.7	9.9	14.5	12.	16.1	13.
16	12.8	8.6	14.5	11.	14.6	12.4
17	13.7	10.0	15.9	13.2	16.3	13.8
18	15.7	13.1	15.4	.13.	13.2	9.4
19	12.8	9.3	13 6	9.5	15.4	12.5
20	13.	9.2	15.2	12.8	15.4	13.
21	13.4	9.7	13.6	11.4	14.3	11.6
22	13.6	10.1	14.1	10.2	14.1	10.
23	12.8	9.	15.	12.5	14.5	11.4
24	14.8	11.5	13.7	10.6	15.2	12.9

The Station having but a small plat of stubble cane, and the stand on this defective, it instituted a series of experiments upon Tchoupitoulas Plantation, Messrs. Soniat Bros. These experiments were selected so as to cover all three prevailing soils of this section of the State, viz., sandy, mixed and black.

RESULTS OF EXPERIMENTS STUBBLE CANE—TCHOUPITOULAS PLANTATION.

No. of Expt.	Manures Used.	Sandy Land		Mixed Land.		Black Land.	
		Total Solids	Cane Sugar	Total Solids	Cane Sugar	Total Solids	Cane Sugar
1	32½ lbs Cotton Seed Meal. 5 lbs Acid Phosphate.	17.0	13.5	18.3	15.7	17.2	13.6
2	30 lbs Cotton Seed Meal. 7½ lbs Acid Phospbate.	16.8	14.5	18.1	15.6	17.4	14.7
3	25 lbs Cotton Seed meal. 12½ lbs Acid Phosphate.	16.5	13.4	17.9	15.3	17.7	14.9
4	18¾ lbs Cotton Seed Meal. 18¾ lbs Acid Phosphate.	16.3	13.6	17.9	15.	17.5	14.6
5	Nothing.	17.2	14.6	17.	14.8	17.5	14.4
6	15 lbs Cotton Seed Meal. 22½ lbs Acid Phosphate.	16.3	13.	16.8	13.3	18.6	15.9
7	30 lbs Cotton Seed Meal. 6 lbs Dried Blood. 28 lbs Acid Phosphate. 4 lbs Muriate Potash.	16.6	13.2	17.9	14.8	17.9	14.8
8	30 lbs Cotton Seed Meal. 6 lbs Dried Blood. 28 lbs Acid Phosphate.	16.8	13.5	17.2	14 3	17.2	14.2
9	30 lbs Tankage.	16.8	13.5	16.6	13.4	16.5	13.2
10	Nothing.	16.3	13.	17.8	14.9	17.5	14.6
11	30 lbs Tankage. 4 lbs Muriate Potash.	16.3	13.	18.5	15.7	18.1	15.5
12	30 lbs Tankage. 20 lbs Gypsum.	18.5	15.9	17.5	14.6	21.0	17.7
13	30 lbs Orchilla Guano.	16.1	13.2	15.5	13.	17.	14.5
14	30 lbs Charleston Floats.	16.1	12.8	17.2	15.	18.1	15.8
15	Nothing.	16.5	13.3	17.9	13.9	18.3	14.4
16	30 lbs Stern's Sugar goods.	17.9	14.	17.9	14.1	17.4	13.8
17	30 lbs Studniczkas Goods.	17.8	13.9	17.	13.3	16.8	12.8
18	30 lbs Rogers' Cane Fertilizer.	15.9	12.5	16.8	13.9	17.8	14.1
19	30 lbs Pacific Guano.	17.5	13.9	15.	11.9	17.9	14.5
20	Nothing.	16.6	14.	17.	14.9	17.2	15.
21	* 24 lbs Nitrate Soda. 28 lbs Acid Phosphate. 4 lbs Muriate potash.	16.5	14.	17.4	15.7	17.2	15.5
22	12 lbs Nitrate Soda. 24 lbs Cotton Seed Meal. 28 lbs Acid Phosphate. 4 lbs Muriate Potash.	16.5	14.3	17.4	15.7	17.9	16.8
23	8 lbs Nitrate Soda. 32 lbs Cotton Seed Meal. 28 lbs Acid Phosphate. 4 lbs Mbriate Potash.	16.3	13.8	16.3	13.8	18.3	16.5
24	28 lbs Acid Phosphate. 4 lbs Muriate Potash. 8 lbs Cart's Rotted Bagasse.	16.8	14.3	17.2	14.9	17.5	15.5
25	8 lbs Cart's Rotted Bagasse.	17.4	14.9	17.7	15.6	18.3	16.5
26	Nothing.	17.2	15.	18.1	16.4	17.5	15.6

*8 lbs. Nitrate Soda applled at three different times.

RESULT OF MANURIAL EXPERIMENTS WITH CANE.

During the season just ended, the Station has several times analysed specimens of cane from the 300 experiments grown

on the grounds. It has also analysed several hundred for the farmers of the State, grown upon every variety of soil, and with perhaps every kind of manure used in varying quantities. In all, over 2000 distinct analyses have been made. Many of these have been published from time to time in the journals of the State. A peculiarity of these results has been noticed by many observing planters, and has been commented upon in correspondences with the Station. The peculiarity is this: On the Station the unfertilized plats have frequently given the highest per centage of sugar. This is easily explained when a close examination of the soil of the Station is made. It is a very black soil which has long been badly cultivated, with little or no drainage, and although its chemical composition is very fair, its execrable physical condition checks the plant in its root development, and prevents the collection and assimilation of that food necessary to a large, continuous growth, and the plant so checked prematurely ripens even in our short seasons.. The amount of sugar in a cane is just in proportion to maturity. Therefore, a plant checked in its growth from any cause, poverty of soil, drouth, etc., at once does the only thing left for it, matures, i. e. stores up sugar. Hence upon poor soils, unfertilized plats in favorable seasons will perhaps always be the richest in sugar. Why then use manures? The reply is, to increase tonnage. The period of growth in this country is very short, and therefore to get the highest results, we must fertilize with quickly available manures, so as to force the cane into a good growth, by the time the cool nights of September and October check vegetation and induce maturity. The manures give increased tonnage but rarely, increased per centage of sugar. It is hoped that at an early day a fertilizer may be found which will accomplish both. But in the use of manures, great care should be exercised in selecting those which, while causing a rapid growth, will at the same time induce a moderate elaboration of sugar. Nitrogenous manures alone produce a sappy, succulent, one sided growth, make a cane rich in ferment and albummoids but low in saccharine matter, except upon soils rich in available mineral matter. Therefore nitrogenous manures should rarely be used alone and never in excessive quantities. The exact quantity to be used per acre cannot be accurately foretold. Sometimes favorable seasons will permit of the appropriation of very large quantities to great advantage, while unfavorable seasons fail to utilize even small quantities. Again, if an excessive quantity used this year is not appropriated by the plant the greater part of it, is lost from the soil or rendered unavailable for the next season. Hence prudence would suggest the application of enough of this kind of manure to make under a medium season, a fair crop. The maximum amount of nitrogen according to this would be from 40 to 60 lbs. per acre, an amount usually contained in 600 and 800 lbs. cotton seed meal. But phosphoric acid and potash must be present either in the manure or in the soil, in readily available forms, in order to com-

bine with the nitrogen to make a perfect plant. The former when present in the right proportions, with nitrogen, causes a quicker and more vigorous growth, than the latter alone, since the presence of this ingredient, [Phosphoric Acid], causes a more rapid translocation of the albummoids [whose formation seems to be the chief function of nitrogen] through the sap or juice of the cane, and at same time conduces to the formation and deposition of sugar.

The potash on the other hand, conspires with the chlorophyl grains of the leaf to form carbohydrates, which are all ultimately in the cane resolved into sugar.

Therefore when soils are deficient in these ingredients, they must be supplied in the manures. Excessive quantities of these ingredients can be used without fear of subsequent loss from the soil, if not utilized the first season. Numerous experiments have abundantly proven this.

But whether excessive quantities of these ingredients in the manure, especially potash, cause excessive quantities in the juice of the cane to the prevention of the crystalization of sugar, are questions now being investigated by the Station.

It is believed that potash exists in available form and quantity in most of the sugar soils of the State. At all events, very small quantities of this ingredient in manures suffice to make large crops, and increased quantities do not enhance either the tonnage or sugar content. On the other hand, the application of phosphoric manures seems to be beneficial to all soils.

From the results of the field experiments of the past year, the Station would say that Nitrogen and Phosphoric Acid are the ingredients absolutely needed for cane on the sugar soils and lands of this State, and that cotton seed meal and soluble phosphates furnish these ingredients in as cheap and as efficient forms as can be obtained by the planters, and that small quantities of potash may be beneficial and can be easily and cheaply supplied in the form of kainite.

When the soil contains a moderate amount of vegetable matter, cotton seed meal and acid phosphate should be used in equal proportions; if deficient, the cotton seed meal can be increased. On pea fallows it can be decreased.

Upon stubble cane, cotton seed meal can be advantageously increased.

Nitrate of Soda has been very effectively used as a top dressing during the past season upon small and late stubble.

The first essential to the successful production of sugar is a large crop. To attain this, the following conditions are demanded: Thorough drainage, excellent preparation of soil, good seed properly planted, judicious manuring, both in quantity quality and mode of application, early culture, deep and thorough—after culture as shallow as possible for good work, and a laying by as early as is consistent with cleanliness and good condition. These being accomplished, nature will do the rest, and a reasonably large crop may be confidently expected.

RECORD OF WEATHER—KEPT BY LOUISIANA SUGAR EXPERIMENT STATION, FOR NOVEMBER. 1886.

Date.	THERMOMETER.					RAIN FALL.
Sept.	9 A. M.	3 P. M.	9 P. M.	Maximum	Minimum.	Inches.
1	66°	70°	68°	70°	41°	.00
2	65°	69°	67°	70°	45°	.00
3	66°	70°	68°	70°	42°	.00
4	64°	69°	67°	69°	44°	.00
5	65°	70°	60°	68	46°	.00
6	64°	69°	54°	65°	45°	.00
7	68°	70°	68°	71°	43°	.00
8	70°	73°	71°	73°	48°	.00
9	72°	75°	71°	75°	49°	1.00
10	70°	73°	71°	73°	48°	.15
11	74°	76°	73°	75°	49°	.00
12	68°	70°	67°	69°	48°	.30
13	65	68°	64°	68°	45°	.45
14	52°	55°	52°	60°	43°	.00
15	50°	55°	52°	59°	40°	.00
16	50°	54°	50°	59°	40°	1.25
17	44°	49°	42°	50°	33°	.00
18	45°	50°	43°	50°	36°	.15
19	48°	60°	48°	60°	40°	.00
20	55°	60°	59°	60°	43°	.00
21	56°	61°	60°	61°	44°	.25
22	57°	61°	60°	61°	46°	1.50
23	60°	65°	60°	65°	50°	.50
24	55°	60°	54°	60°	45°	.00
25	43°	51°	50°	53°	40°	.00
26	44°	52°	50°	52°	39°	.00
27	43°	51°	51°	51°	38°	.00
28	44°	52°	50°	52°	40°	.00
29	46°	55°	52°	55°	42°	.00
30	44°	53°	51°	53°	40°	
						5.55 inches
Average	57°	62°	58°			

Lowest Temperature......75°
Lowest Temperature .....33°

RECORD OF WEATHER KEPT BY LOUISIANA SUGAR EXPERIMENT STATION FOR DECEMBER 1886.

Date.	THERMOMETER:					RAIN FALL.
August.	9 A. M.	3 P. M.	9 P. M.	Maximum.	Minimum.	Inches.
1	54°	60°	50°	60°	49°	
2	54	60	50	59	48	
3	53	59	49	58	47	1.25
4	36	58	50	40	34	
5	33	40	34	33	27	
6	30	37	33	30	26	
7	44	52	32	52	30	
8	44	49	40	52	30	
9	50	52	40	53	35	
10	59	65	50	65	34	
11	70	73	58	74	45	
12	73	75	70	75	48	
13	73	76	70	76	49	
14	73	76	71	76	49	
15	73	76	71	76	49	
16	74	77	72	77	50	
17	77	79	74	79	52	
18	77	79	74	79	52	.50
19	76	78	74	78	51	
20	73	75	72	75	49	
21	71	74	70	74	48	
22	73	78	74	75	49	
23	71	74	70	74	48	
24	71	73	70	73	47	
25	70	72	71	72	45	
26	72	75	70	75	49	
27	72	74	68	74	47	
28	71	74	73	74	47	1.00
29	70	73	69	73	42	
30	67	70	68	70	40	
31	66	71	64	71	41	
						2.75 inches
Average	63	68	64			

Highest Temperature........79
Lowest Temperature........26

CONDENSED WEATHER RECORD OF SUGAR EXPERIMENT STATION FROM MARCH 1, 1886, to JANUARY 1, 1887.

Month.	Average Temperature.	Maximum Temperature.	Minimum Temperature.	Rainfall In Inches.
March	63°	80°	37°	9.13
April	69	87	41	7.32
May	76	93	57	3.59
June	83	97	69	11.50
July	83	96	68	3.25
August	84	97	66	4.18
September	80	91	59	5.24
October	73	87	39	1.
November	66	75	33	5.55
December	65	79	26	2.75

Rainfall for three spring months 20.04
Rainfall for three summer months 18.93
Rainfall for three fall months 11.79

COTTON.

BULLETIN No. 8

OF THE

STATE EXPERIMENT STATION

BATON ROUGE, LA.

Wm. C. Stubbs, Ph. D.,

—DIRECTOR—

—ISSUED BY—

THOMPSON J. BIRD,

COMMISSIONER OF AGRICULTURE, BATON ROUGE, LA.

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1887.

LOUISIANA SUGAR EXPERIMENT STATION,
BATON ROUGE, LA.

Major T. J. Bird, Commissioner of Agriculture, Baton Rouge, La.:

Dear Sir—I hand you herewith for publication Bulletin No. 8, covering experiments in cotton, made during the past season on the State Experiment Station at Baton Rouge, La. I regret that pressure of official duties has prevented an earlier preparation.

Respectfully,

WM. C. STUBBS, Director.

COTTON

ITS HISTORY.

The history of cotton is coeval with human history. The earliest records of the Asiatics and Egyptians speak of it. We are informed by the great Roman author Pliny, that garments of cotton were worn by the ancient Egyptians more than one thousand years before Christ. Surplices were made of it for their priests. Herodotus speaks of this plant as growing in India 450 B. C. and bearing a fleece more delicate and beautiful than that of sheep. The time of the origin and culture of cotton in Asia is hidden in great obscurity. It certainly antedated the Macedonian conquest. From that time to the present, it has steadily grown in favor and extent of cultivation.

Cotton cloth was used as awnings in a theatre by Lucullus and by Cæsar to cover the forum and to pave the street leading from his house to the Capitoline Hill. The generals of Alexander brought the plant and fabrics made from it to Greece. Cotton has been grown from time immemorial in Central Africa and it is the opinion of many historians that it was carried thither from Asia. It is certain that a knowledge of this plant and its products was obtained by the Europeans from India and Egypt.

Cotton was found growing wild in certain parts of America by Columbus in 1492 and subsequent explorers found it in abundance along the banks of the Mississsippi and its tributaries. It is certain that the Aztecs and the Incas had obtained a good knowledge of the cultivation and manufacture of cotton long before the occupation of America by the Europeans.

It is therefore pretty generally believed that cotton is indigenous to Asia, Africa and America. It is more certain that it is not native of Europe and was not generally known their until a comparatively recent date. The history of cotton in the United States dates from 1784, when a shipment of eight bales was made to Europe, since that time its cultivation has steadily increased until now our annual crop reaches over six millions of bales.

BOTANICAL RELATIONS.

Cotton belongs to a large class of plants, known to the Botonists as Malvacaæ. Of this class, beside cotton, we have in cultivation the okra and the hollyhock. There are said to be many species of cotton—two of which only are cultivated in the South—the one upland or common cotton; Gossipium Herba-

ceum, the other "Sea Island cotton," "Gossipium Barbadense." The latter is cultivated only on the coast or neighboring islands, while the former constitutes the chief staple of the Southern States. The bloom of upland cotton is white or cream colored the first day, turning red on the next and falling on the third, leaving a small boll enveloped in the calyx. This boll continues to develop until it reaches the size and shape of an egg, when on maturity it splits into three to five cells, containing the seed, wrapped in a tomentose wool. This wool constitutes the lint or fibre which clothes the world.

HABITUDES.

Cotton is emphatically a child of the sun and flourishes only in warm latitudes. Its heliotropic tendencies are even more marked than the poetical sunflower. Its leaves receive the first glow of morning light and following the King of Day, dismiss it at eve in the west with dewy regrets. With us it is an annual herb. Further south it appears to be a shrub, while under the tropics, it is a small tree enduring many years. It is an exogenous plant, with two seed leaves and a long top root. Among our field crops it stands without a fellow—alone—and peculiar in its habits and characteristics. Its nearest relation among our cultivated plants, as before mentioned, is the okra, with which it crosses, to form some of the many evanescent varieties of *okra-cotton*, now on the market. By its long deep tap root, it is enabled to withstand droughts and to pump up from the lower layers of the soil, plant food, unavailable to fibrous rooted plants, which is quickly assimilated by its large leaf surface. Hence it thrives better on poor land than any other field crop.

Formerly cotton was not grown north of the isothermal line 36°, but under the influence of phosphatic manures, its cultivation in late years has been extended several degrees beyond this line. The region best adapted to successful culture is included between the 30th and 35th degrees of North Latitude. North of this belt the seasons are too precarious, while south of it, excessive rains and depredations of the caterpillar greatly interfere with large production.

PLANTING AND CULTIVATION.

The soil best adapted to cotton is yet not fully decided. Clay loams, well drained and sandy loams, resting upon clay subsoils are both highly recommended. Both should contain a fair amount of vegetable matter.

The width of the rows and the distance apart of the stalks in the row, must depend upon the fertility of the soil and the rain supply. In poor lands or on soils subject to drouth during fruiting season, thin planting must be practiced to obtain the largest results. Mr. David Dickson, the great cotton planter of

Georgia, now no more, always contended that cotton needed distance only one way. If therefore the rows were wide, it could be crowded in the drill and *vice versa.*

Deep and thorough preparation of soil, followed by pulverization should always precede planting The planting should be done by some of the excellent and cheap cotton planters now to be everywhere found. since only the machine will give that uniform and straight stand, which so facilitates the subsequent chopping. It furthermore economizes the seed, a point of great importance, when the true value of this article as a manure and feed stuff is appreciated. The first plowing of cotton may be as deep and thorough as possible, but all subsequent workings ought to be as shallow as the character of the land will permit, since root-breaking to this plant is almost a disaster. The implements in general use for the cultivation of cotton are the scooter and scrape, the solid and buzzard-wing sweeps, the side harrows and the numerous cultivators. After every heavy rain the soil should be stirred and during drought a shallow implement run just deep enough to break the continuity of the pores of the soil and to form an upper layer, which shall act as a mulch to conserve the moisture in the soil, has often been found highly beneficial. Grass is an enemy of the cotton planter and should never be permitted (if possible to prevent) to obtain possession of his fields. In cotton as in all other crops the hoe should be used as little as possible. It is element of cost excessive to bear and, with this plant often causes the disease known as "*sore shin*" by breaking or removing the epidermis of the tender stalk in the effort of the hoeman to remove the last spire of grass.

When to plant, must be decided by the climate and by the character of the soil. When the ground is warm enough to promptly germinate the seed and give a vigorous healthy plant, then the seed can be wisely trusted in the earth. This is usually the case in this latitude in April. Planting in May is often hazardous, on account of the delay in germination, due to the prevalence of drouths at this period. When May planting is practiced, the seed should be covered rather deeply and firmed with a light roller.

A practice prevails among some of our progressive planters to plant late and highly fertilize. By this means, they claim a crop of grass which so frequently infests an early planting, is destroyed, the costly hoe labor avoided and the plant pushed quickly into vigor by the underlying fertilizer, soon occupies the ground and renders the after culture both simple and and inexpensive. As a rule, it is best to plant poor unfertilized lands early and rich or highly fertilized lands late.

COMPOSITION OF THE COTTON PLANT.

A five hundred pound bale of lint cotton, will require fifteen hundred pounds of air dried "seed cotton." Of the latter, one

third or five hundred pounds is lint, another third or five hundred pounds is hulls and the remaining five hundred pounds is kernels. To produce this fifteen hundred pounds of seed cotton, there will be required five hundred pounds of leaves, fifteen hundred pounds of stalks, five hundred pounds of roots and five hundred of bolls or burrs. In other words to produce a five hundred pound bale of lint cotton, an acre must produce forty-five hundred pounds of vegetable matter, or two and a quarter tons.

To produce this amount the following mineral ingredients will be required.

	Lint	Seed	Stalks	Leaves	Burrs	Roots	Total
Phosphoric Acid	.65	14.10	5.43	5.35	4.54	1.91	31.98
Potash.........	2.10	13.40	11.36	9.65	9.31	5.84	51.66
Lime	1.48	3.85	13.27	18.64	17.65	5.71	60.60
Magnesia	.58	4.95	4.48	3.14	3.98	2.01	19.14
Sulphuric Acid.	.31	1.38	2.50	7.28	8.60	1.10	21.17
Oxide of Iron..	.15	.66	.94	2.97	3.32	1.74	9.78
Chlorihe	.45	.61	3.18	3.44	2.67	1.99	12.34
Soda	.53	1.44	4.56	5.50	5.74	2.88	20.65
Silica	.09	0.39	2.14	4.48	9.25	1.98	18.23

In other words a soil must furnish the above ingredients besides a goodly amount of Nitrogen to make a five hundred pound bale of cotton.

But fortunately most soils hold large contents of all these ingredients and supply them abundantly to all plants, except Phosphoric Acid, Potash and Nitrogen. To supply these needed ingredients is the prime object of manuring. But when the cotton planter makes the proper disposition of the products of cotton, let us see how far he needs the aid of manure to maintain the original fertility of his soils. The leaves and capsules should be permitted to fall to the ground and not removed as is usual, by the depredations of half starved cattle. The stalks should be knocked down and plowed under instead of being destroyed by fire. The seed should be returned to the soil, or else when sold to the oil mill their equivalent in a first class commercial fertilizer should be purchased. When all this is done only the trifling loss of about ½ pound of phosphoric acid and 2 pounds of Potash is sustained to each acre. Theoretically then cotton is the least exhausting crop grown, but how is it in practice? Unfortunately the decennial census returns cry out in thunder tones against us and tell the world in convincing figures that our acre yields are fast decreasing under constant cropping in cotton. Our soils are being rapidly depleted and exhaustion will sooner or later come, unless we stop the numerous leaks now found on many cotton plantations. Wisdom and economy would suggest the careful return to the

soil of every product of cotton save the lint. Bnt there are two incidents in cotton growing, which tend in themselves to to soil depletion, which are usually over looked by the agricultural chemist, and rarely appreciated by the planter. 1st. Cotton is planted in early spring and harvested in late fall, its period of growth extending through the entire summer and much of the fall. During this period of growth, with clean culture under hot suns nitrification is most intense and with it a rapid oxidation of the vegetable matter of the soil. This partially explains why cotton is the most profitable crop on poor land, but it also tells in plainer language, that the vegetable mould "*humus*," so essential to fertility, is fast disappearing and with it soil nitrogen. Even our rich alluvial lands once thought inexhaustible, from this cause, coupled with the baneful practice of selling cotton seed, are now responding in gratifying returns to the well directed use of Nitrogenous manures. A crop of pea vines turned under every second or third year, would aid materially in restoring this lost humus.

2d. Cotton is removed in late fall and our lands are left naked unoccupied and exposed to the drenching rains of our semitropical winters and much of the finer material (which furnishes the plant food in all soils) is washed away, and a goodly quantity of plant food is carried so far down into the soil as to be forever beyond the reach of plants, even the tap root of cotton. The first loss is very severe in rolling or hilly lands, as is shown by the numerous furrowed red hillsides which everywhere meet the eye of the traveller through the South Atlantic States. The second loss is greatest in sandy lands andleast in clay. It has been clearly demonstrated, that a loss of soil fertility will always occur whenever lands are left in bare fallow. A plant suitable for occupying the ground between the gathering of one crop and the planting of another, would be an inestimable boon to the cotton planter. Oats sown in the cotton in August or September and lightly harrowed in or planted in October and November, after the cotton has been harvested affords only a partial remedy.

MANURES FOR COTTON.

The following taken from Bulletin No. 2, issued over a year ago, explains the manures used elsewhere successfully.

Thanks to the Experiment Stations, and a large class of progressive farmers in the South, the manurial requirements of cotton are well understood. The following formula has been used with excellent results all through the South, viz :

700 lbs. Cotton Seed Meal.
1,100 lbs. Acid Phosphate:
200 lbs. Kainite.

This mixture is fully the equal of the best guanos found in our markets, and will cost considerably less. If objection be found to mixing it on the plantation, some of the factories in New Orleans will manipulate it at a small price over cost of materials. The above is recommended with the

belief drawn from a large number of experiments, carefully conducted by the writer, that cotton seed meal is fully the equal of cotton seed as a source of Nitrogen. Cotton seed ought never to be used as a fertilizer until its oil, *which has no fertilizing value whatever*, is extracted. Every ton of cotton seed yields 35 to 40 gallons of oil, which usually sells at about 30 cents per gallon. Therefore, if all the cotton seed, over and above what is required for planting, could be passed through a mill for the extraction of its oil, and the latter turned into money, what a vast wealth would be added annually to the cotton industry which is now buried with the seed. Unfortunately the present prices of all cotton seed products are low, and, therefore, but little inducement can be offered the farmer by the mills to exchange his seed for meal. The seed now used by the mills are purchased outright, and the proceeds rarely return to the ferm upon which the seed was grown. *This is radically wrong* Cotton, when everything except the lint is returned to the soil, is one of the least exhausting crops, but when the seed are sold to the mills and cattle consume the bolls and staks left in the field (as is frequently the case), it rises high in the scale of exhausting crops, and sooner or later the soils upon which it is continually grown will reach that point of depletion as to cease to yield remunerative returns without the addition of fertilizers. Whenever the seed go to thr mills, the meal and hulls, especially the former, should be returned to the farm with proper care. The Sothern cotton planter should buy no Nitrogen. The manure from his domestic animals reinforced by his cotton seed or cotton seed meal (should he sell his seed), ought to grow all his crops. Under no circumstances should stable manure or cotton seed be used alone under cotton. For small grain and corn their use is applicable, but not advisible. They should both be composted with acid phosphate. "The compost is the best manure in the world for cotton," is a common declaration among intelligent planters of Georgia and Alabama. There is a power in the combination, a strength in the mixture, a ferment in the union which multiplies roots, enlarges foliage and increases the fruit. The compost, prepared difficulty for each crop, not only economizes, but properly and effectually utilizes the waste products of the farm, and in its preparation and use there is developed in the farmer powers of observation and reflection hitherto latent. Complete manures or Guanos should not be purchased until all home resources for manure have been exhausted, and only then when its guaranteed constituents are known to be adapted to the soils and crops. Acid Phosphates of a high grade are the best to use in a compost. Below is appended the formula best suited for cotton:

100 bushels Cotton Seed.
100 bushels Stable Manure.
1 ton Acid Phosphate, high grade.

If the above is to be used on very sandy lands, one-half ton of Kainite may be advantageously added. Dissolve in water and use the latter to wet the compost.

Since the success of a compost depends materially upon the proper manner of preparing it, full directions are here inserted:

DIRECTIONS FOR MAKING COMPOST.

Take an equal part of the Stable Manure, say ten bushels, and spread it out in a level place, under shelter, to the nepth of three inches. Sprinkle over it 100 pounds of Acid Phosphate. Next spread over this ten bushels of Cotton Seed, made thoroughly wet. Then another sprinkle of 100 pounds of Acid Phosphate. Continue this rotation till the quantities are exhausted and then cover with a rich earth, from the fence corners, five inchs deep. Permit it to remain until ready for use, four to six weeks will do, and cut vertically down with a mattock. Mix well and apply from 200 to 1000 pounds per acre in the drill at the time of planting.

Be careful to wet the Cotton thoroughly and buy only a first-class Acid Phosphate.

How far results obtained elsewhere were applicable here remained to be determined by experiments, accordingly a series of systematic experiments in cotton was instituted at the State Experiment Station, for the purpose of determining the following questions:

1st—What ingredients of commercial manures do our soils need for the successful production of cotton. Having determined this we have

2nd—What form of these ingredients was most beneficial to cotton.

3d—What quantity produced the best results.

The first question is asked directly in plat 5 and incidentally in them all. The second and third questions are answered as to nitrogen in plat 5, as to phosphoric acid in plat 6, and as to potash in plat 7.

Of the nitrogenous manures we have used nitrate of soda (15 per cent nitrogen); sulphate of ammonia (21 per cent of nitrogen); dried blood (10 per cent nitrogen), and cotton seed meal (7 per cent nitrogen). The first and second are mineral, the third animal, and the fourth vegetable forms. Such quantities of each are taken as to represent equal quantities of nitrogen and each are used alone and in combination in quantities representing one-third, two-third, and a whole ration.

Beside these fish scrap, tankage and a mixture of nitrate soda, sulphate of ammonia and cotton seed meal, called mixed nitrogen, are also used.

The phosphatic manures are represented by dissolved bone black, acid phosphate, orchilla phosphate, bone dust, and Charleston floats. The potassic manures are supplied in kain-and the sulphate and muriate of potash. Both of these are used in like combinations and quantities as the nitrogenous manures.

The following are the experiments with results:

NITROGENOUS MANURES.

Size of Experiment One-Twentieth of Acre.

PLAT NO. 5—COTTON.

No. 1—Nothing.
No. 2—7 lbs Nitrate Soda.
No. 3—5 2-11 lbs Sulphate of Ammonia.
No. 4—10 lbs Dried blood.
No. 5—15½ lbs Cotton Seed Meal.
No. 6—14 lbs Acid Phosphate.
No. 7—4½ lbs Muriate Potash.
No. 8 { 15½ lbs Cotton Seed Meal. 14 lbs Acid Phosphate. }
No. 9 { 15½ lbs Cotton Seed Meal. 14 lbs Acid Phosphate. }
No. 10—Nothing.
No. 11 { 14 lbs Acid Phosphate 4½ lbs Muriate Potash. } =Mixed Minerals.
No. 12 { 3½ lbs Nitrate Soda Mixed Minerals. } =⅓ Ration.

No. 13 { 7 lbs Nitrate Soda=⅔ ration.
Mixed Minerals.
No. 14 { 10½ lbs Nitrate Soda=1 ration.
Mixed Minerols.
No. 15—Mixed Minerals.
No. 16 { 2 13-22 lbs Sulphate Ammonia=⅓ ration.
Mixed Minerals.
No. 17 { 5 2-11 lbs Sulphate Ammonia=⅔ ration.
Mixed Minerals.
No. 18 { 7 17-22 lbs Sulphate Ammonia=1 ration.
Mixed Minerals.
No. 19—Mixed Minerals.
No. 20—Nothing.
No. 21 { 5 lbs Dried Blood=⅓ ration.
Mixed Minerals..
No. 22 { 10 lbs Dried Blood=⅔ ration.
Mixed Minerals.
No. 23 { 15 lbs Dried Blood=1 ration.
Mixed Minerals.
No. 24—Mixed Minerals.
No. 25 { 7¾ lbs Cotton Seed Meal=⅓ ration.
Mixed Minerals.
No. 26 { 15½ lbs Cotton Seed Meal=⅔ ration.
Mixed Minerals.
No. 27 { 23¼ lbs Cotton Seed Meal=1 rati n.
Mixed Minerals.
No. 28—Mixed Minerals.
No. 29 { 4½ lbs Fish Scraps=⅓ ration.
Mixed Minerals.
No. 30 { 9 lbs Fish Scraps=⅔ ration.
Mixed Minerals
No. 31 { 13½ lbs Fish Scraps=1 ration.
Mixed Minerals.
No. 32—Nothing.
No. 33—Mixed Minerals.
No. 34 { 2½ lbs Nitrate Soda
1¾ lbs Sulphate Ammonia.
2 1-10 lbs Cot. Seed Meal.
Mixed Minerals. } =Mixed Nitrogen ⅓ ration.
No. 35 { Mixed Nitrogen=⅔ ration.
Mixed Minerals.
No. 36 { Mixed Nitrogen=1 ration.
Mixed Minerals.
No. 37—Mixed Minerals.
No. 38 { 7½ lbs Tankage=⅓ ration.
4½ lbs Muriate Potash.
No. 39 { 15 lbs Tankage=⅔ ration.
4½ lbs Muriate Potash.
No. 40 { 22½ lbs Tankage
4½ lbs Muriate Potash.
No. 41—15 lbs. Tankage.
No. 42—Nothing.

TREATMENT OF PLAT NO. 5.

Manures put out April 15th, bedded April 15th, planted April 17th, off-barred May 11th and 12th, chopped May 17th, dirted 26 and 27th, with scooter and scraper, hoed June 24th to 29th, plowed out and laid by June 30 and 31st, with scooter and scraper.

YIELD OF PLAT NO. 5.

No. of Experiment.	First Picking.	Second Picking.	Third Picking.	Fourth Picking.	Fifth Picking.	Total.	Total Per Acre.	Kind of Manure.
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	
1	4	6	8	9	½	27½	550½	Nothing.
2	5	8	9	12	¼	34¼	685	Nitrate Soda.
3	7	8	10	9	½	34½	690	Sulphate Ammonia
4	6	6	10	9	¼	31¼	625½	Dried Blood.
5	9	12	13	10	½	44½	390½	Cotton Meal.
6	8	9	10	8	½	35½	710½	Acid Phosphate.
7	5	6	9	10	½	30½	610½	Muriate Potash.
8	12	18	20	10	¼	60¼	1205½	Cotton Meal. Acid Phosphate.
9	6	12	15	12	1	46	920½	Cotton Meal. Muriate Potash.
10	4	7	8	9	1¼	29¼	565	Nothing.
11	8	9	8	14	½	39½	780	Mixed Minerals.
12	8	13	12	11	½	44½	890	Nitrate Soda.
13	9	14	13	14	1	51	1020	Group.
14	9	15	14	13	1¼	52¼	1045	
15	5	18	17	11	1	52	1040	Mixed Minerals.
16	5	20	18	10	1½	54½	1090	Sulphate
17	6	20	30	6	1	63	1260	Ammonia
18	8	26	19	10	1½	64½	1290	Group.
19	8	20	22	10	2	63	1260	Mixed Minerals.
20	6	21	21	4	1½	53½	1070	Nothing.
21	11	16	18	6	1	52	1040	Dried
22	12	18	20	9	1¼	60¼	1205	Blood.
23	12	18	21	9	1	61	1220	Group
24	8	18	20	6	1	53	1050	Mixed Minerals.
25	14	25	30	4	1	74	1480	Cotton Meal.
26	15	21	33	4	1¼	81¼	1625	Group.
27	15	30	35	2	1	83	1660	
28	8	16	20	8	1	53	1060	Mixed Minerals.
29	9	21	18	10	½	58½	1170	Fish Scrap.
30	13	24	20	4	1	62	1240	Group.
31	14	25	21	6	1	67	1340	
32	6	12	13	4	1	36	720	Nothing.
33	7	17	21	2	1¼	48¼	965	Mixed Minerals.
34	8	22	18	3	1	52	1040	Mixed
35	9	21	17	5	1	53	1060	Nitrogen.
36	10	23	20	5	1¼	59¼	1185	Group.
37	8	16	20	4	1¼	49¼	985	Mixed Minerals.
38	12	18	14	4	1	49	980	Tankage.
39	14	20	15	4	1	51	1080	Group.
40	14	21	29	5	1	70	1400	
41	14	20	16	4	1¼	55¼	1105	Tankage.
42	6	12	13	4	0	35	700	Nothing.

An inspection of above will show that while the nitrogenous manures alone have slightly increased the yield whenever it was combined, this increase has been very decided. It also shows that the results obtained with cotton seed meal both alone and in combination were greater than with other forms of nitrogen, and that large quantities of nitrogen have not paid for increased cost.

PHOSPHORIC ACID MANURES—*Size of Experiment* 1-30 *acre.*
PLAT NO. 6—COTTON.

No. 1—Nothing.

No. 2—9 lbs. Dissolved Bone Black, 16 per cent soluble.

No. 3—10 lbs Acid Phosphate.

No. 4—10 lbs Orchilla Phosphate.

No. 5—10 lbs Bone Dust.

No. 6—10 lbs Charleston Floats.

No. 7 { 10 lbs Cotton Seed Meal. / 3 lbs Muriate Potash. } Basal Mixture.

No. 8 { 4½ lbs Dissolved Bone Black=⅓ ration. / Basal Mixture.

No. 9 { 9 lbs Dissolved Bone Black=⅔ ration. / Basal Mixture.

No. 10 { 13½ lbs Dissolved Bone Black=1 ration. / Basal Mixture.

No. 11—Nothing.

No. 12—Basal Mixture.

No. 13 { 5 lbs Acid Phosphate=⅓ ration. / Basal Mixture.

No. 14 { 10 lbs Acid Phosphate=⅔ ration. / Basal Mixture.

No. 15 { 15 lbs Acid Phosphate=1 ration. / Basal Mixture.

No. 16—Basal Mixture.

No. 17 { 4½ lbs Precipitated Dissolved Bone Black=⅓ ration. / Basal Mixture.

No. 18 { 9 lbs Precipitated Dissolved Bone Black=⅔ ration. / Basal Mixture.

No. 19 { 13½ lbs Precipitated Dissolved Bone Black=1 ration. / Basal Mixture.

No. 20—Nothing.

No. 21—Basal Mixture.

No. 22 { 5 lbs Orchilla Phosphate=⅓ ration. / Basal Mixture.

No. 23 { 10 lbs Orchilla Phosphate=⅔ ration. / Basal Mixture.

No. 24 { 15 lbs Orchilla Phosphate=1 ration. / Basal Mixture,

No. 25—Basal Mixture.

No. 26 { 5 lbs Bone Dust=⅓ ration. / Basal Mixture.

No. 27 { 10 lbs Bone Dust=⅔ ration. / Basal Mixture.

No. 28 { 15 lbs Bone Dust=1 ration. / Basal Mixture.

No. 29—Nothing.

No. 30—Basal Mixture.

No. 31 { 5 lbs Charleston Floats=⅓ ration. / Basal Mixture.

No. 32 { 10 lbs Charleston Floats=⅔ ration. / Basal Mixture.

No. 33 { 15 lbs Charleston Floats=1 ration. / Basal Mixture.

No. 34—Basal Mixture.

No. 35 { 3 lbs Gypsum=⅓ ration. / Basal Mixture.

No. 36 { 6 lbs Gypsum=⅔ ration. / Basal Mixture.

No. 37 { 9 lbs Gypsum=3/3 ration. / Basal Mixture.

No. 38—Basal Mixture.

No. 39—Nothing.

Treatment of No. 6 same as No. 5.

YIELD OF PLAT NO 6.

No. of Experiment.	First Picking.	Second Picking.	Third Picking.	Fourth Picking.	Fifth Picking.	Total.	Total Per Acre.
1	9	13	19	6	¼	47¼	1432
2	5	13	22	9	1	50	1500
3	5	15	18	8	¾	46¾	1402
4	6	12	11	5	½	34½	1035
5	8	14	9	2	¼	33¼	1005
6	8	15	8	4	¼	35¼	1072
7	7	13	15	5	½	40½	1215
8	8	13	17	4		42	1260
9	8	13	14	6	½	41½	1245
10	9	13	12	3	¼	37¼	1132
11	5	10	8	2	1	26	780
12	6	11	11	3		31	930
13	8	12	18	4		42	1260
14	9	13	16	4		41	1230
15	10	12	14	4		40	1200
16	6	8	6	5		25	750
17							
18							
19							
20							
21				*			
22							
23							
24							
25							
26	4	8	12	10		34	1020
27	5	9	10	8		32	960
28	6	10	11	6		33	990
29							
30	4	1	6	5		23	690
31	4	12	12	5		33	990
32	5	10	11	4		30	900
33	5	14	11	6		36	1080
34	4	12	13	4		33	990
35	5	11	12	4		32	960
36	5	11	10	5		31	930
37	5	10	10	5		30	900
38	5	11	10	7		33	990
39	4	8	10	4		26	780

*These experiments were partially destroyed by rains in June, and hence not recorded.

A part of the above plat was seriously damagod by the heavy and continuous rains of June, and results for complete comparison are vitiated. However the soluble forms of phosphoric acid have given increased yields over the insoluble forms in bone dust and floats.

POTASSIC MANURES.

Each Experiment One-Thirtieth of Acre.

PLAT NO. 7—COTTON.

No. 1—Nothing.
No. 2—12 lbs Kainite.
No. 3—3 lbs Muriate Potash.
No. 4—6 lbs Sulphate Potash.
No. 5 { 10 lbs Cotton Seed Meal. } =Meal Phosphate.
{ 10 lbs Acid Phosphate, }
No. 6 { 12 lbs Kainite=⅓ ration.
{ Meal Phosphate.
No. 7 { 24 lbs Kainite=⅔ ration.
{ Meal Phosphate.
No. 8 { 36 lbs Kainite=1 ration.
{ Meal Phosphate.
No. 9—Meal Phosphate.
No. 10—Nothing.
No. 11 { 3 lbs Muriate Potash=⅓ ration.
{ Meal Phosphate.
No. 12 { 6 lbs Muriate Potash=⅔ ration.
{ Meal Phosphate.
No. 13 { 9 lbs Muriate Potash=⅔ ration.
{ Meal Phosphate.
No. 14—Meal Phosphate.
No. 15 { 6 lbs Sulphate Potash=⅓ ration.
{ Meal Phosphate.
No. 16 { 12 lbs Sulphate Potash=⅓ ration.
{ Meal Phosphate.
No. 17 { 18 lbs Sulphate Potash=1 ration.
{ Meal Phosphate.
No. 18—Meal Phosphate.
No. 19—Nothing.

Treatment of No. 7 same as No 5.

YIELD OF PLAT NO. 7.

No. of Experment.	First Picking.	Second Picking.	Third Picking.	Fourth Picking.	Fifth Picking.	Total Yield.	Yield per acre.
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs	lbs.
1	3	8	3	4	....	18	540
2	4	8	4	2	....	18	540
3	5	9	3	3	....	20	600
4	4	8	4	3	....	19	570
5	8	16	9	4	....	37	1110
6	6	18	11	5	....	40	1200
7	6	16	13	2	....	37	1110
8	5	17	14	3	1	40	1200
9	7	21	9	5	1½	42½	1275
10	4	10	4	5	2	25	750
11	4	13	24	8	½	49½	1485
12	5	12	25	8	¼	50¼	1507
13	6	12	26	6	....	50	1500
14	8	14	25	2	....	49	1470
15	9	13	25	3	....	51	1530
16	8	14	26	2	....	50	1500
17	7	13	25	2	....	47	1410
18	8	12	24	3	....	47	1410
19	4	9	8	2	....	23	690

No form of Potash has given decided gains.

PLAT NO. 8—COTTON.

No. 1—25 lbs Studniczka's Guano.
No. 2—50 lbs Studniczka's Guano.
No. 3—25 lbs Planters Fertilizer.
No. 4—50 lbs Planters Fertilizer.
No. 5—24 lbs Raw cotton seed.
No. 6—36 lbs Raw cotton seed.
No. 7—48 lbs Raw cotton Seed, and 5 lbs Acid Phosphate.
No. 8—72 lbs Raw cotton seed.
No. 9—48 lbs Raw cotton seed, 5 lbs Acid Phosphate, and 5 lbs kainite.
No. 10—Nothing.
No. 11—36 lbs Compost.*
No. 12—36 lbs Compost.* and 5 lbs. Kainite.
No. 13—72 lbs Compost *
No. 14—72 lbs Compost.* and 5 lbs. Kainite.
No. 15—96 lbs Compost.*
No. 16—120 lbs Compost.*

*Compost prepared as directed in Bulletin No. 2, and this Bulletin page 8.

Treatment of Plat 8 same as No. 5.

POPULAR MANURES.

Each Experiments 1-30 Acres.

YIELD OF PLAT NO. 8.

No. of Experiment.	First Picking.	Second Picking.	Third Picking.	Fourth Picking.	Fifth Picking.	Total.	Yield Per Acre.
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
1	8	10	4	1		23	690
2	10	16	5	1		32	960
3	7	15	5	1		28	840
4	9	18	9	4		40	1200
5	8	12	4	2	1	27	810
6	8	15	5	1		29	870
7	9	15	8	2		34	1020
8	8	14	6	2	1¼	30¼	937
9	8	15	9	2	1	35	1050
10	4	8	6	2		20	600
11	10	16	9	2		37	1110
12	9	17	8	3		37	1110
13	10	18	10	2		40	1200
14	10	17	12	3		42	1260
15	12	18	11	3		44	1320
16	13	20	12	4		49	1470

In the above, Acid Phosphate has increased the yield of Raw cotton seed, while Kainite has given no decided gains.

Besides the above the following experiments were made in different modes of cultivation. The manures used were the same, and they varied only in the methods of cultivation.

CULTIVATION EXPERIMENTS.

PLAT NO. 9—COTTON.

No. 1—May 20th, plowed with bull tongue; June 24th, plowed with bull tongue; July 10th, laid by with scooter and scraper.

No 2—May 26th, plowed with bull tongue; June 24th, plowed with scooter and scraper; July 10th, laid by with scooter and scraper.

No. 3—May 20th, plowed with scooter and scraper; June 24th, plowed with scooter and scraper; July 10th, laid by with scooter and scraper.

No. 4—May 20th, plowed with scooter and scraper; June 24th, plowed with bull tongue; July 10th, laid by with scooter and scraper.

No. 5—May 20th, plowed with turn shovel; June 24th, plowed with turn shovel; July 10th, laid by with scooter and scraper.

No. 6—May 20th, plowed with turn shovel; June 24th, plowed with bull tongue; July 10th, laid by with scooter and scraper.

No. 7—May 20th, ploweed with turn plow; June 24th, plowed with turn plow; July 10th, laid by with scooter and scraper.

No. 8—May 20th, plowed with turn plow; June 24th, plowed with bull tongue: July 10th, laid by with scooter and scraper.

YIELD OF PLAT NO. 6.

No. 1	39 lbs	1170 lbs per acre.
" 2	42 "	1260 " " "
" 3	41 "	1230 " " "
" 4	46 "	1380 " " "
" 5	45 "	1350 " " "
" 6	42 "	1260 " " "
" 7	36 "	1080 " " '
" 8	43 "	1290 " " "

The following Varieties of Cotton were planted:

PLAT NO. 10—COTTON.

No. 1—Jower's Improved.
No. 2—Cherry's Long Staple.
No. 3—S. B. Maxey's Cotton.
No. 4—Shine's Early Prolific.
No. 5—Griffin's Improved.
No. 6—Taylor's Improved.
No. 7—Bancroft's Extra Prolific Herlong.
No. 8—Peterkin's Improved.
No. 9—Jones' Improved.

CULTIVATION LIKE PLAT NO. 5.

Small quantities of above seed were used, and it is very difficult to decide upon the relative merits of the varieties of cotton on small areas. They will be tested on a larger scale next year.

CONCLUSION.

The results of the experiments above given but confirm the hitherto entertained opinion that cotton seed meal was our cheapest best form of nitrogen for cotton, and combined with soluble phosphate and kainite, give a manure fully the equal of any to be obtained. On lands badly worn and deficient in vegetable matter, the cotton seed meal may be advantageously increased even to an equal quantity with acid phosphate. On lands having already a tendency to excessive weed, it may be decreased. therwisie the formula given in Bulletin No. 2 and repeated in this Bulletin page 6, will be found best adapted to the requirements of cotton.

STATE BUREAU OF AGRICULTURE,
OFFICE OF COMMISSIONER,
Baton Rouge, La., March 22d, 1887.

The following partial list of Commercial Fertilizers. sold in this State, is published in this Bulletin, in order to give the public the benefit of the quarantees. Later a complete list with guranteed analyses, selling prices and commercial values per ton will be published.

T. J. BIRD,
Commissioner of Agriculture.

GUARANTEED ANALYSES OF COMMERCIAL FERTILIZERS, AS RENDERED TO COMMISSIONER OF AGRICULTURE BY DEALERS AND MANUFACTURERS TO WHOM LICENSES HAVE BEEN ISSUED FOR SEASON 1886-87.

NAME OF FERTILIZER OR CHEMICAL.	BY WHOM REPORTED. Name.	BY WHOM REPORTED. Address.	By whom Manfactured.	Where Manufactured.	Weight of Package.	Nitrogen.	PHOSPHORIC ACID. Soluble.	PHOSPHORIC ACID. Reverted.	PHOSPHORIC ACID. Insoluble	Potash.	Cash Price per ton to Farmers.
Sterns Ammoniated	Stern's Fert. & Chem. Mf'g Co	14 Union St., New Orleans	Stern's Fert. & Chem. M'fg Co.	New Orleans	200	2 to 3	6 to 8	3 to 4	....	2 to 3	$ 30.00
Sterns Pure Ground R w Bone	" " " " "	" "	" " " " "	" "	200	4½ to 4¾	....	....	20 to 25	....	35.00
Acid Phosphate	" " " " "	" "	" " " " "	" "	200	....	14 to 18	1 to 3	....	....	16 to 25
Kainite	" " " " "	" "	Imported	Imported	200	....	....	....	....	13 to 14	12 to 14
Acid Phosphate	Wm. Garig & Co.	Baton Rouge	Imported	Engl nd	150	....	15	5	.2	....	....
Soluble Pacific Guano	W. P. Richardson	33 Carondelet St., N. O.	Pacific Guano Co., Boston	Charleston, S. C., and	200	215 to 255	7 to 8.75	3 to 3.75	2 to 2.50	1 to 1.50	cot. grade
Soluble Pacific Guano	Rep. Glidden & Curtes, Boston			Woods Hall, Mass.	200	240 to 3	6½ to 8	2½ to 4	2 to 3	3¼ to 4¼	sug grade
Studniczkas Standard Sugar Cane Fert	Henry Studniczka	41 North Peters St., N. O	Wahl Bros	Chicago, Ill.	100	2½ to 3	9 to	11	1 to 2	....	30.00
Studniczkas Standard Sugar Cane Fert	Henry Studniczka	" "	" "	" "	100	2½ to 3	9 to	11	1 to 2	2½	....
Gossoypium Phopho	Geo. W. Scott M'fg Co,	Atlanta, Georgia	Geo. W. Scott M'fg Co	Atlanta, Georgia	200	240 to 2½	6 to 6½	3.80 to 4	1½ to 2½	1½ to 2¼	....
Scott's Best Acid Phosphate	" " "	" "	" " "	" "	200	....	7½ to 8½	4½ to 5½	1½ to 2½	2 to 2¾	....
Scott's High Grade Acid Phosphate	" " "	" "	" " "	" "	200	....	8 to 9	5 to 6	2 to 2¾	....	....
Standard Home Mixture Guano	Meridian Fertilizing Factory	Meridian, Mississippi	Meridian Fertilizing Factory	Meridian, Mississippi	200	2¼ to 2½	7½ to 9	9 to 11	1 to 2	2¼ to 3	....
Bone and Potash	" " "	" "	" " "	" "	200	....	8 to 10	10 to 13	1 to 2	2¼ to 3	....
Challmette Mills Fertilizer	W. A. Ober, Agent	197 Gravier St., N O.	G. Ober & Sons Co	Cor Adams & S Peter St. N. O.	125	2 to 3½	4 to 5	3½ to 4½	1¼ to 1¾	2 to 3	....
Sugar Fertilizer	Planters Fertilizers M'fg Co.	111 Magazine St., N. O	Planters Fertilizing M'fg Co.	New Orleans	100	3 5 to 4	7 5 to 9	....	....	2 to 3	22.50
Cotton Fertilizer	" " " "	" "	" " " "	" "	100	3	10	....	....	2	22.50
Atlantic Fertilizer	Pelzer Rodyers & Co.	Charleston, S C	Atlantic Phosphate Co	Charleston, S. C.	200	2.05	6.50	1.50	1.50	2	....
Armour Bone Meal	H. Studniczka	41 North Peters St. N. O	Armour & Co	Chicago, Ill.	100	4 to 5	....	....	25 to 28	....	28.00
Standard Cotton and Sugar Guano	Haynes & Rodyers	101 Poydras St., N. O.	Farmers Fertilizing Co	Syracuse, New York	200	1 to 2	8 to 9	....	3 to 4	4 to 6	....
Armour Hog Tankage	H. Studniczka S. Sole Agent	41 North Peters St., N O.	Armour & Co.	Chicago	100	8 to 9	....	....	12 to 15	....	26.00
Acid Phosphate	Planters Fertilizing Co.	111 Magazine St., N. O.	Imported	England	150	....	15.16	5	.2	....	....
Kainite	" " "	" "	"	Germany	....	....	....	....	....	12 to 14	....

LOUISIANA DEPARTMENT OF AGRICULTURE

REPORT

FOR THE MONTH OF APRIL, 1887.

SHOWING

AREAS PLANTED, CONDITION OF CROPS ON THE FIRST OF MAY, AND OTHER MATTERS RELATING TO AGRICULTURE IN THE STATE.

———AND———

BULLETIN No. 9,

———OF THE———

EXPERIMENT STATIONS

GIVING ANALYSES AND VALUATION OF FERTILIZERS.

THOMPSON J. BIRD,
COMMISSIONER.

BATON ROUGE:
PRINTED BY LEON JASTREMSKI, STATE PRINTER.
1887.

CIRCULAR NO. 1.

CROP REPORT

FOR APRIL 1887, RETURNED TO THE DEPARTMENT MAY 1, 1887

STATE DEPARTMENT OF AGRICULTURE,
BATON ROUGE, LA., May 4, 1887.

COTTON.

The reports from all parts of the State indicate that the months of January, February, March and April, has been favorable for preparing the ground. The acreage planted compared with this date last year is several points in excess, but on account of the drouth commencing in March and extending mostly throughout April combined with cold nights,has prevented the germination of the seed last planted and in some instances delayed planting, consequently the reports of the condition from some portions of the State are not favorable, giving some apprehension of the stand.

CORN.

The comparative acreage has increased in the State, and the condition is excellent in the South and Southwestern portions of the State, and in some instances the crop is laid by in good condition. While in some localities in the northern parishes there is some complaint of stand, attributed mostly to drouth and in some localities to birds.

RICE.

The acreage is about the same, but the condition will not compare favorable with last year, attributted mostly to the causes that affected cotton.

SUGAR CANE.

On account of the very favorable season prevailing during the past winter, both the acreage and condition is reported far in excess of last year.

SORGHUM.

About the same as last year.

IRISH POTATOES.

Both acreage and condition about the same. While the season for planting was very favorable, and the stand excellent. The condition was very considerably injured by the drouth in March and April, retarding growth and in some instances causing blight on exhausted lands in the southern parishes.

OATS.

The acreage about the same as last year, but the condition is reported far below. Those planted in the fall was never more promising up to the commencement of the drouth. Now the testimony received from all parts of the State indicate an unusually short crop, in many instances taking rust and prematurely ripening.

ONIONS.

The acreage and condition of this crop is considerably increased comparatively, and is now considered an important crop in Louisiana.

ORANGES.

The reports indicate, as compared with last year, several points increase in acreage, and a very considerable increase in condition. But in both instances they are still far behind the average crop.

CLIPPING OF WOOL.

About the same as last year.

LIVE STOCK.

Their condition, considering the very indifferent attention given them in the State in many instances, receiving no food or shelter during the winter is remarkably good. No unusual prevalence of contageous diseases except with swine. Horses, mules, cattle and sheep, are comparatively in excellent con.l

tion. Some complaint in isolated localities of charbon and buffalo gnats, and of dogs with sheep. By far the greatest loss in live stock is in hogs, with cholera or some similar disease. The past winter has been favorable, being both mild and dry. The information received indicate an increased interest in stock raising throughout the State, with a disposition to improve the breed of all kinds. This we are rejoiced to hear, as it will result in more care, and the providing of better shelter by the farmer, as he will naturally prize the improved stock more than the unimproved, and will almost unconsciously bestow more care upon them, and an animal representing one hundred dollarr will not be as apt to suffer from neglect as one worth twenty-five dollars, and will have the effect of greatly augmenting the value of all, and the adoption of this policy will most certainly make farming more profitable. It is certainly worthy of note that in the North and West the value of farm lands is far in excess in those States where greater attention is given to the raising of improved stock. And in consideration of the methods of advancement open to the farmer of Louisiana, one of the first means which must suggest itself to one of ordinary thinking capacity, is the improvement and increase of his live stock. This will bring about one of the diversifications that the writer has so often recommended, and will in his opinion be the means of greatly improving the farming methods, besides largely increasing the value of the farm lands throughout the State.

THE EXPERIMENT STATIONS

Are progressing satisfactory. The one at Kenner has over 300 experiments in cane—60 in corn, 32 in oats, 10 in Sorghum, 10 in grasses and clovers and 10 in rice. The drouth has seriously injured the experiments in oats, which one month ago promised larger yields than last year.

At Baton Rouge there are 51 experiments in grasses and clovers, 75 in corn, 110 in cotton, 10 in tobacco, 13 in oats and 8 in forage crops—the latter to be ensilaged for the purpose of testing practically the value of silos in Louisiana—27 experiments in Irish potatoes have just been gathered. The protracted drouth, now happily broken, has seriously interferred with the complete development of the grasses, etc.

TABLE

Showing Area Planted, Condition of Growing Crops, Live Stock, &c., May 1st, 1887.

PARISHES.	COTTON.		CORN.		RICE.		SUGAR CANE.		SORGHUM		IRISH POTATOES		OATS.		ONIONS.		ORANGES.			
	Acreage compared with this date last year.	Condition compared with this date last year	Acreage planted compared with May 1, 1886.	Condition compared with May 1, 1886.	Acreage planted compared with May 1, 1886.	Condition compared with May 1, 1886.	Acreage planted compared with May 1, 1886.	Condition compared with May 1, 1886.	Acreage planted compared with May 1, 1886.	Condition compared with May 1, 1886.	Acreage planted compared with May 1, 1886.	Condition compared with May 1, 1886	Acreage planted compared with May 1, 1886.	Condition compared with May 1, 1886.	Acreage planted compared with May 1, 1886.	Condition compared with May 1, 1886	Acreage planted compared with May 1, 1886.	Condition compared with May 1, 1886.	Clip of Wool.	Live Stock.
Acadia	105	100	95	90	110	90	100	100	......	......	110	85	110	75	......	......	......	......	100	100
Ascension	100	125	100	120	80	95	100	140	......	......	120	125	100	100	100	100	......	......	......	105
Assumption	......	......	105	110	110	110	100	125	......	......	100	100	100	100	......	......	......	......	......	105
Avoyelles	85	95	110	115	95	95	110	130	80	100	125	100	90	85	100	100	......	......	......	105
Baton Rouge E.	105	95	110	100	100	95	105	150	100	100	110	100	110	85	105	100	......	......	95	105
Baton Rouge W.	100	100	110	80	100	70	150	110	100	110	105	80	100	80	......	......	......	......	......	105
Bienville	105	90	105	95	......	......	95	95	95	95	110	100	110	80	......	......	......	......	105	95
Bossier	100	80	100	85	......	......	......	......	100	......	100	80	95	90	......	......	......	......	100	100
Caddo	100	75	100	75	......	......	......	......	......	......	100	100	75	50	......	......	......	......	100	100
Calcasieu	100	75	105	90	115	95	100	75	......	......	100	65	110	75	......	......	......	......	100	100
Caldwell	110	115	110	115	100	100	100	100	100	100	105	115	100	95	100	100	......	......	100	100
Cameron	......	......	100	100	......	......	100	100	......	......	100	75	50	100	......	......	......	......	......	105
Carroll East	100	100	110	90	......	......	......	......	100	100	100	100	100	100	......	......	......	......	100	95
Carroll West	95	100	100	110	......	......	......	......	120	100	100	1 0	95	90	......	......	......	......	......	95
Catahoula	100	100	100	95	100	100	100	100	100	100	105	100	100	90	......	......	......	......	100	100
Claiborne	105	95	100	95	......	......	100	100	100	100	100	100	90	85	100	100	......	......	100	95
Concordia	110	100	105	110	......	......	......	......	100	110	100	100	110	100	......	......	......	......	100	95
DeSoto	100	90	100	85	......	......	......	......	100	90	100	100	100	70	100	100	......	......	100	95
Feliciana East	100	85	100	90	......	......	80	80	......	......	80	65	90	65	......	......	......	......	95	105
Feliciana West	95	100	110	100	......	......	......	......	100	100	90	90	100	95	100	120	......	......	100	105
Franklin	100	100	110	100	......	......	......	......	......	......	100	90	90	80	......	......	......	......	......	100
Grant	100	100	100	110	......	......	100	110	100	110	100	110	90	115	100	100	......	......	110	100
Iberia	110	105	115	120	85	95	1 0	135	100	105	105	110	100	100	100	100	100	95	......	100
Iberville	110	100	110	115	90	90	125	150	100	100	150	115	100	100	......	......	......	......	......	105
Jackson	100	90	100	90	......	......	100	85	85	100	......	......	100	80	......	......	......	......	100	95

Jefferson	......	......	95	120	100	110	110	135	100	100	110	120	125	85	125	120	130	150	130	100
Lafourche	......	......	110	120	100	100	115	140	100	100	125	85	110	85	110	100	100	150	......	105
Lincoln	100	75	100	65	......	......	100	100	......	......	100	100	75	65	......	......	......	......	......	100
Liv ngston	100	95	105	110	100	80	105	100	......	......	100	85	105	75	......	......	......	......	105	105
Madison	100	100	100	100	......	......	......	......	......	......	110	100	110	90	......	......	......	......	......	95
Morehouse	100	100	105	100	......	......	100	100	105	105	110	100	95	90	......	......	......	......	100	95
Natchitoches	95	85	95	75	......	......	......	......	100	100	95	90	95	85	......	......	......	......	......	95
Ouachita	95	105	100	100	......	......	......	......	......	......	100	95	100	85	......	......	......	......	100	95
Plaquemines	......	......	200	125	100	125	100	150	......	......	150	50	......	......	......	......	100	200	......	100
Pointe Coupee	105	115	100	95	......	......	120	150	......	......	100	100	100	90	......	......	......	......	110	105
Rapides	105	95	100	120	......	......	110	120	80	75	100	105	100	85	......	......	......	......	100	105
Red River	90	80	100	80	......	......	......	......	......	......	100	100	100	100	......	......	......	......	110	100
Richland	100	90	100	100	......	......	......	......	......	......	100	100	100	100	......	......	......	......	100	95
Sabine	80	75	110	90	70	90	100	100	100	90	110	60	80	50	......	......	......	......	......	100
St. Bernard	100	90	[illegible]	110	100	100	95	115	......	......	135	90	150	125	125	130	100	150	......	95
St. Charles	......	......	100	110	80	100	125	110	......	......	90	100	100	125	100	100	100	125	......	105
St. Helena	100	85	100	95	......	......	90	160	......	......	100	80	100	80	......	......	100	100	......	105
St. Landry	100	85	105	110	110	80	100	115	......	......	100	100	110	95	......	......	......	......	100	100
St. Martin	120	100	120	110	135	120	85	105	......	......	100	100	......	......	130	120	100	100	100	105
St. Mary	......	......	110	115	80	110	120	130	......	......	90	150	100	100	......	......	......	......	......	105
St. Tammany	100	75	100	95	100	100	200	150	......	......	100	75	100	75	......	......	......	......	110	105
Tensas	95	95	115	105	......	......	......	......	......	......	100	115	100	80	100	120	......	......	100	95
Terrebonne	......	......	105	110	100	100	110	135	......	......	100	100	100	100	100	110	90	110	......	105
Tangipahoa	100	90	100	90	......	......	110	100	......	......	100	90	100	90	......	......	......	......	100	100
Union	100	75	100	75	......	......	100	100	100	100	100	100	100	80	......	......	......	......	100	105
Vermilion	115	80	100	105	......	......	110	135	......	......	100	100	100	75	......	......	......	......	......	105
Vernon	100	90	100	90	90	90	110	110	100	100	100	100	100	100	100	100	......	......	110	105
Washington	100	100	105	110	95	100	115	100	......	......	100	100	105	85	......	......	......	......	100	105
Webster	100	90	100	85	......	......	......	......	......	......	100	80	100	85	......	......	......	......	......	105
Winn	105	90	110	130	100	100	80	90	120	100	100	100	80	100	......	......	......	......	90	105

Extracts From Remarks of Parish Correspondents.

Acadia—This parish is suffering very much from drouth, prevénting late corn and cotton from coming up, and retarding the growth of such crops as are up; gardens very backward.

Ascension—Season has been very favorable; no disease among stock.

Assumption—The season for the cultivation of corn and cane has been remarkably good; fields are clean and plants look well; the parish is well supplied with labor, and the Sunday law acts like a charm here. We had a fine rain on the 23d inst.

Avoyelles—No disease has affected stock this year; on the contrary they are unusually healthy and in good condition; the winter was the mildest I have ever seen; the recent cold spell has retarded the planting of cotton, otherwise the season has been very favorable for planting.

East Baton Rouge—April has been favorable for working, but very unfavorable for growth; dry weather throughout with very cool nights and even cool days; everything considered the prospect is encouraging, and so far as the cane crop is concerned, much more promising than last year.

Bienville—Dry weather accompanied with winds have been unfavorable, effecting the stand of cotton and corn, and preventing the corn growing as rapidly as it should; however, it is looking well; the oat crop did badly owing to the drouth; there will be about ⅓ crop of fruit; stock healthy and in fine condition.

Bossier—January and February very pleasant; season throughout rather dry; considerable trouble to secure a good stand of corn or cotton; April also dry oats a failure, that is late planting; stock doing well however; grass is failing for want of rain; fruit injured by last frost; insects very numerous, more so than usual.

Caddo—Crops suffered from drouth, resulting in very poor stand of cotton and corn, too dry for it to come up and oats are a complete failure.

Calcasieu—The poor condition of the crops are due to the continued drouth; however, it was broken by a fine rain the night of April 22d; stock on the range are doing as well as could be expected, and in fine condition.

Caldwell—Very little cotton planted; the weather has been so exceedingly dry that there would be but little chance of getting a stand if it was planted; stock have suffered considerable for want of water. Considerable fresh land is being cultivated and a greater disposition to fertilize the old.

East Carroll—The seasons have been unusually good; the land better prepared than for years; cotton about all planted, but not up to a stand yet; the black birds have done more injury to corn than ever known before; the stand would have been good had they not dug it up as fast as it appeared, necessi-

tating in many cases the plowing up and planting over; slight rain on April 17.

West Carroll—Seasons have been very favorable with the exception of being a little too cold for cotton; we have had quite a dry spring but sufficient rain fall to bring up cotton and keep vegetation growing slowly; crops clean and promise well; no disease with stock; rain on the night of the 17th of April.

Catahoula—April has been very dry, and a great many had to plant their corn over on account of the birds pulling it up; they have been more bother this spring than ever before; corn and cotton about two weeks ahead of 1886; water here was two inches higher than last year, but has already gone off, and planting can be done at once on the low lands; last year the water came on in May. The gnats have been very bad, but they remained only about five or six days, the large ones; every one stopped working their stock and kept up large smokes around which the animals stood the entire day; quite a number of horses and mules were killed by them; otherwise stock in good condition.

Claiborne—We have had a remarkably dry winter and spring but not very cold; consequently our lands are better prepared than usual; cotton has been somewhat retarded by drouth and the planters were becoming uneasy, but the rain in the last five days has dispelled all gloom, and they are now buoyant; some little disease among stock but nothing very serious.

Concordia—Too much dry weather; fine rain on the 21st inst., the first for five weeks; the ground is well pulverized and some cotton up; all planted and the prospects for a good stand was never better; we have escaped damage from water, and the farmer seems cheerful; so much for good levees.

DeSoto—The drouth unprecedented for the season of March and April; not half the cotton planted has germinated and a great deal yet to plant; it is very doubtful if that planted three weeks since will come up even with rain during the coming week; if not that will necessitate the replanting of over half the crop at this late date; about two-thirds stand of corn, which is looking well; where it has been worked; almost an entire failure of the oat crop; stock in unusually good condition for this season; coal and iron companies organized capital stock, $250,000.

East Feliciana—The season has been rather dry, but the land broke better than usual, and as there has been no time lost from bad weather, farmers are better up with their work; corn small but looking weil and growing very fast; good rain on the 20th; oats also a failure; we have had no sickness, people, stock and poultry have been remarkably healthy.

West Feliciana—The planting season has been dry, and with cold northerly winds vegetation has been slow; the season has been favorable for putting land in fine condition, but too dry in the hill lands for quick germination or growth; hence poor stands of corn and crop small; three-quarters of the cotton

crop planted, and land for the entire crop broken; dry weather prevented some from planting; oats headed up with at least 25 per cent less results than last year.

Franklin—The spring so far has been dry and too cool for corn and cotton; planters well up with planting; oats not doing well, has been too dry; however, the general outlook is more favorable than last year.

Iberia—We need rain, but as yet nothing suffering; condition of fields never better; cane doing remarkably well.

Iberville—Cane had a fine start in February but a cold March and April delayed the growth; the drouth now existing is causing some alarm, but so far has done no harm; land is in better order than it has been for years, and crops more promising.

Jackson—The unusual dry cold weather has retarded the planting and growth of the crops; light rain on the 17th inst.

Jefferson—The weather from January 1st to March 10th was very favorable to all growing crops; since that time, cool nights, high winds and a protracted drouth have conspired to retard growth of all kinds; oats have succumbed to severe drouth taking the rust and prematurely ripening with low prospects; stand of cane and corn are very fine; rice and sorghum just planted; potatoes and onions largely cultivated; the former have suffered from blight doubtless superinduced by improper cultivation, want of fertilization and long drouth.

Lafourche—The growth of corn and cane has been somewhat retarded by the dry weather, but the drouth was broken on the night of the 22d inst., by a fine rain that has thoroughly saturated the soil; on many plantations peas have been sown and corn laid by, and now that we have had rain, the corn will be rapidly disposed of; the cane has been better cultivated than it has for years, and at less expense; so far potato crop seriously affected; no disease has affected stock.

Lincoln—Dry weather has seriously affected corn and cotton, being too dry for seed to germinate, therefore very bad stands; oats did very badly; sugar cane only planted in small patches, condition fine.

Livingston—Condition of crops not as good as had been anticipated; the season has been good for working etc., but too dry; result, bad stand and slow growth; the cloudy weather however has been of considerable benefit, causing the seed to come up very fast for the last few days.

Madison—This has been an unusually dry spring; the ground has been better prepared than for years; very little cotton up, and unless we have rain soon the general stand will be seriously injured; corn is small but good color and well worked; stock doing well and in fine condition; some trouble with gnats.

Morehouse—The spring opened very early and unusually dry; we had a fine rain on the 17th inst., and all crops are in

fine condition; farmers well up with their work; stock in better condition than last year; however quite a number have died from the effects of the gnats, causing the animals to act as if they had the colic; the remedy which has been used successfully is 1 pint of whiskey and two tablespoonfuls of Bi-carb. soda at a dose and repeated every hour until the animal is intoxicated; it has relieved all cases taken in time, but when they could not be intoxicated no good result; nothing will do any good unless taken in time.

Natchitoches—The bright prospects promised by the opening of an early spring has been cut short by a drouth of over five weeks duration; the rains of the 17th and 22d inst., may bring up the plant in some sections, but have not been heavy enough in most parts of the parish to insure a good stand, besides the dry north winds and cool nights will not help the case; prospects look blue for corn and will for all crops if we do not have rain soon; the corn as a general thing is small, the stand not very good, has suffered in the low lands from the wire worm; stock in good condition.

Ouachita—Too dry for crops, cannot get a stand; fine season for work; not enough rain to bring the seed up and nights too cool; there has been an increase in fertilizers this year, both commercial and home made, principally cotton seed and cotton seed meal used; the gnats have played havoc with stock; mules, horses and cattle have died in great numbers; they are worse than any year since, and equal to 1884.

Pointe Coupee—The season has been too dry and has retarded the crops considerably; since the rain of the 23d they have materially improved; stock in fine condition and no serious disease has affected them.

Rapides—The favorable prospects of the early spring has been somewhat blasted by six weeks drouth, preventing the germination of seed, thereby rendering an imperfect stand of cotton and late corn; farm work well up; cane and early corn doing well; however the cool nights prevent as rapid a growth as desired; condition of stock good.

Red River—A continued drouth has prevented farmers from plowing and planting; hence the small per cent of acreage and condition of crops reported; poor stand of corn throughout the parish.

Richland—Soil in fine condition; season too dry and cool for cotton; corn not as good as desired.

Sabine—The spring so far has been too cold and dry; crop prospects not as good as should be; no disease among stock.

St. Bernard—Irish potatoes have been attacked by a disease supposed to have been caused by an insect, damaging the crop about 25 per cent or more; we had rain on the 15th and 17th inst., which was much needed.

St. Charles—Season favorable for planting cane and a fine

stand but growth retarded by cool nights and drouth; rain on the 22d, first for five weeks; stock in good fix.

St. Helena—The season throughout may be considered favorable; however, the cool nights and drouth caused an inferior stand of cotton and corn, the former died out in many instances after it came up, necessitating replanting; the ground was so dry and hard some had to stop their plows; corn small but generally good; pastures are not as good as usual; therefore stock not looking as well as they should, but no disease with cattle or hogs.

St. Landry—The season has been favorable through the winter and up to the present for preparing the soil and farm work, but the drouth, north winds and cool nights has retarded the growth; corn small but healthy; stock looking well owing to the mild winter.

St. Martin—Appearance of crops generally good; will need rain before two weeks; no damage as yet caused from drouth; cotton, corn, rice and potatoe crops much larger than last year.

St. Mary—The cane crop is somewhat increased, condition remarkable; season very favorable; corn also good; rice crop just planted; no increase in acreage.

St. Tammany—No rain for some time; very little cotton planted; some are covering with plows, others waiting for rain.

Tensas—The drouth at this date, April 18th, unbroken and very little cotton up; corn looks bad; cotton seed in the ground over two weeks and no signs of sprouting; gnats are very bad on stock.

Terrebonne—The seed cane kept remarkably well, and planted under favorable circumstances, now presents a flattering prospect; the stubble both first and second year are very fine; fine rain on the 22d inst. at night thus terminating a drouth of several weeks duration; planters are well advanced with their work and have their crops in a condition to withstand any excess of rain which may succeed the unusually dry spring we are having, and with an average good season we can safely calculate on a much larger crop of sugar than last year.

Union—Poor stands of cotton and corn owing to cool and dry weather; very little cotton up and not more than half planted; corn very small and damaged by cut worm and birds; farmers are well up with their work as there has not been a day since the 15th of February, to prevent farm work; yet it has been too dry to break ground well unless it was done early in the spring; oats will be almost a failure unless we have rain soon.

Vermilion—Have had but one heavy rain since January 20th, and that was on March 9th, and not a sprinkle since: Very heavy dews and fogs have kept land, where in good order, moist; cane, both stubble and plant much better stand than ever known; is about three weeks earlier than an ordinary season

and about five weeks earlier than last year; cotton planting has been very much retarded by the drouth, which lasted about five weeks ending on the 22d with a fine rain, since which the bulk of the crop has been planted.

Washington—There has been a drouth which retarded the crops very much, oats especially; had a fine rain on the 23d inst; stock in good condition.

Webster—The cause of decrease in condition is owing to the protracted drouth; in many localities cotton will not come up; the stand of corn is not good; oats cut short from the drouth and will be very short; Irish potatoes also considerably damaged by the potato bug.

Winn—The area of cotton about the same as last year but owing to the absence of rain last month the seed have not yet germinated, and now that the weather is too cool to hasten germination since the moisture has been supplied by rain, a bad stand will result, and I think will necessitate a general replanting; the stand of the early corn is perfect and the plant healthy; however, the stand of the late planting is bad; no disease among stock, and condition good; there has been a rice mill established among us, and will probably increase the crop in the future.

RECORD OF WEATHER LOUISIANA SUGAR EXPERIMENT STATION, FOR JANUARY 1887.

Date. January.	Temperature. 9 A. M.	3 P. M.	9 P. M.	Maximum	Minimum.	Comparison of Wet Bulb.	Dry Bulb.	Total Rainfall.	State of Weath'r	REMARKS.
1	34°	40°	35°	40°	33°	33°	34°	.00	Clear.........	
2	36	45	35	45	34	34	36	.00	Clear & Cool.	
3	25	32	30	32	22	24	25	.00	Clear	
4	32	50	47	50	23	31	32	.00	Cloudy.......	
5	39	54	40	55	34	38	39	.75	Cloudy.......	
6	39	43	40	45	39	38	39	.03	Cloudy.......	
7	39	43	40	45	38	39	39	.80	Fair..........	
8	49	48	43	50	40	48	49	.00	Fair..........	
9	49	58	49	60	45	48	49	.00	Fair,.........	
10	31	45	40	48	28	29	31	.10	Clear	
11	34	47	48	50	27	32	34	.20	Fair	
12	50	59	55	64	45	48	50	.00	Fair	
13	65	70	59	73	52	65	65	.00	Fair	
14	55	65	60	69	39	50	55	.00	Fair	
15	49	63	50	65	37	47	49	.00	Fair	
16	60	68	63	69	45	47	60	.00	Fair	
17	48	65	63	65	40	45	48	.00	Clear	
18	41	54	53	55	30	37	41	.09	Clear	
19	49	68	60	70	45	45	49	.00	Clear	
20	54	76	54	77	48	53	54	.00	Cloudy.......	
21	55	77	54	77	51	54	55	.00	Cloudy.......	
22	66	74	70	74	51	66	66	.29	Cloudy.......	
23	65	79	63	79	62	65	65	1.00	Cloudy.......	
24	70	76	70	79	61	70	70	.02	Fair	
25	70	79	69	79	62	68	70	.00	Fair	
26	70	78	68	78	63	70	70	.12	Fair	
27	70	80	75	82	61	68	70	.00	Fair	
28	71	79	75	80	62	68	71	.00	Fair	
29	69	75	73	79	63	65	69	.00	Fair	
30	68	77	74	78	60	65	68	.00	Clear	
31	69	78	73	79	62	65	69	.00	Clear	

Highest temperature during month 82°
Lowest temperature during month 22°
Total rainfall for month 3.31 inches.
Average daily rainfall .16.

WEATHER RECORD OF LOUISIANA SUGAR EXPERIMENT STATION, FOR FEBRUARY, 1887.

February. Date.	TEMPERATURE. 9 A. M.	3 P. M.	9 P. M.	Maximum	Minimum.	Comparison of Wet Bulb.	Dry Bulb.	Total Daily Rainfall, in inches.	State of Weath'r	REMARKS.
1	64°	78°	70°	79°	61°	62°	64°	.00	Clear...	
2	67	80	72	80	63	64	67	.00	Clear...	
3	64	80	70°	80	61	61	64	.00	Clear ..	
4	65	70	68	71	61	64	65	.00	Cloudy.	
5	58	55	57	69	55	57	58	.00	Clear ..	
6	59	69	60	70	56	57	59	.00	Clear ..	
7	61	68	65	72	60	56	61	.00	Clear ..	
8	63	69	67	74	61	60	63	.00	Clear ..	
9	71	74	70	76	65	70	71	.00	Clear ..	
10	72	76	73	78	69	68	72	.00	Clear ..	
11	71	75	71	77	68	69	71	.00	Clear ..	
12	66	75	72	76	67	67	69	.00	Fair ...	
13	67	73	70	75	64	65	67	.00	Fair ...	
14	68	70	68	72	63	67	68	.00	Fair ...	
15	65	69	65	70	62	64	65	.00	Clear ..	
16	65	68	60	70	60	65	65	.00	Cloudy.	
17	63	70	69	72	61	63	63	.27	Rainy..	
18	64	68	65	70	60	64	64	.23	Rainy..	
19	64	65	60	70	61	64	64	.10	Cloudy.	
20	65	65	60	70	62	65	65	.75	Rainy..	
21	67	69	60	72	63	67	67	2.63	Rainy..	
22	70	76	73	74	63	69	70	1.25	Cloudy.	
23	62	69	68	64	59	61	62	.00	Cloudy.	
24	61	65	64	60	55	60	61	.00	Clear ..	
25	57	60	59	55	40	55	57	.00	Clear ..	
26	56	59	61	60	50	54	56	.00	Fair ...	
27	43	55	53	50	35	42	43	.00	Fair ...	
28	41	50	48	44	30	38	41	.00	Fair ...	

Highest temperature during month 80°
Lowest temperature during month 30°
Total rainfall during month 5.23.
Average daily rainfall .19 of an inch.

RECORD OF WEATHER LOUISIANA SUGAR EXPERIMENT STATION

March 1887.

Date. March.	Temperature. 9 A. M.	3 P. M.	9 P. M.	Maximum	Minimum.	Comparison of Wet Bulb.	Dry Bulb.	Total Daily Rainfall, in inches.	State of Weath'r	REMARKS.
1	59°	65°	58°	68°	40°	54°	59°	.00	Clear ..	
2	60	65	59	70	45	58	60	.00	Clear ..	
3	65	70	70	73	60	62	65	.00	Clear ..	
4	68	78	75	79	61	65	68	.00	Clear ..	
5	63	72	60	76	58	60	63	.00	Clear ..	
6	68	79	65	81	63	65	68	.00	Clear ..	
7	68	75	70	77	55	68	68	.45	Cloudy.	
8	69	78	70	80	59	69	69	1.00	Rainy ..	
9	65	75	70	78	54	65	65	.14	Cloudy.	
10	68	67	65	75	58	68	68	.00	Clear ..	
11	58	55	53	76	55	58	58	.00	Clear ..	
12	59	57	54	80	56	59	59	.00	Clear ..	
13	56	54	51	78	55	56	56	.00	Clear ..	
14	51	50	48	65	50	51	51	.00	Clear ..	
15	48	45	43	67	45	48	48	.00	Clear ..	
16	55	52	48	80	54	55	55	.21	Clear ..	
17	51	64	54	65	44	51	51	.00	Fair ...	
18	54	63	48	66	48	54	54	.00	Fair ...	
19	54	59	54	60	54	54	54	.00	Fair ...	
20	54	59	48	60	53	54	54	1.47	Fair ...	
21	54	58	50	59	52	54	54	.00	Rainy..	
22	52	64	50	65	50	52	52	.00	Fair ...	
23	46	63	51	64	44	44	46	.00	Fair ...	
24	49	63	57	65	55	57	59	.00	Fair ...	
25	55	59	56	60	53	53	55	.00	Fair. ..	
26	45	57	55	58	43	42	45	.00	Clear ..	
27	51	56	57	59	50	50	51	.00	Clear ..	
28	45	48	46	50	43	44	45	.00	Clear ..	
29	49	63	47	65	48	47	49	.00	Clear ..	
30	47	58	43	60	52	46	47	.00	Clear ..	
31	55	65	60	79	63	53	55	.00	Clear ..	

Highest temperature during month 81°.
Lowest temperature during month 40°.
Total rainfall during month 3.27.
Average daily rainfall .15

RECORD OF WEATHER LOUISIANA SUGAR EXPERIMENT STATION
APRIL 1887.

Date.	TEMPERATURE.					Comparison of		Daily Rainfall.	State of Weath'r	REMARKS.
April.	9 A. M.	3 P. M.	9 P. M.	Maximum	Minimum.	Wet Bulb.	Dry Bulb.			
1	65°	70°	64°	78°	48°	63°	65°	.00	Clear...	
2	63	69	60	70	43	60	63	.00	Clear...	
3	66	72	65	74	46	64	66	.00	Clear...	
4	69	77	70	79	53	68	69	.00	Fair....	
5	65	68	60	69	55	60	65	.00	Clear...	
6	59	74	65	76	47	57	59	.00	Clear...	
7	70	80	69	81	52	69	70	.00	Fair....	
8	68	73	63	75	60	65	68	.00	Fair....	
9	70	74	60	74	58	67	70	.00	Clear...	
10	60	70	65	72	50	58	60	.00	Clear...	
11	65	73	65	75	55	62	65	.00	Clear...	
12	70	78	74	80	58	68	70	.00	Fair....	
13	70	80	69	82	59	66	70	.00	Fair....	
14	70	73	68	82	58	70	70	.00	Cloudy.	
15	76	79	69	84	60	75	76	.00	Cloudy.	
16	75	76	71	84	61	74	75	.00	Cloudy.	
17	75	80	72	83	60	74	75	.00	Clear...	
18	75	80	73	84	61	72	75	.00	Cloudy.	
19	76	79	70	84	63	73	76	.00	Cloudy.	
20	74	80	71	84	60	71	74	.00	Cloudy.	
21	71	78	72	82	58	68	71	.00	Fair....	
22	70	79	73	81	57	69	70	.00	Fair....	
23	69	74	70	80	61	68	69	1.85	Rain ...	
24	65	74	69	78	59	64	65	.00	Fair....	
25	65	79	70	80	57	63	65	.36	Cloudy.	
26	64	80	75	83	59	63	64	.00	Clear,..	
27	69	82	73	84	66	67	69	.00	Clear...	
28	68	79	71	82	64	65	68	.00	Fair....	
29	75	84	79	85	70	74	75	.00	Fair ...	
30	78	87	80	89	70	77	78	.00	Cloudy.	
								.00	Cloudy.	
								2.21		

Highest temperature during month 89°.
Lowest temperature during month 57°.
Total rainfall during month 2.21.
Average daily rainfall .073.

LOUISIANA STATE UNIVERSITY & A. & M. COLLEGE,
BATON ROUGE, LA., May 1, 1887.

Major T. J. Bird, Commissioner of Agriculture, Baton Rouge, La.:

Dear Sir—I hand you herewith analyses of fertilizers made up to date. I believe they cover all sold in the Southern part of the State. There are one or two brands sold in North Louisiana which have not been analyzed, being unable to obtain as yet samples.

Respectfully,

WM. C. STUBBS, State Chemist.

LOUISIANA FERTILIZER LAW.

The last Legislature passed a fertilizer law which went into effect September 1, 1886. Since a full understanding of the provisions and penalties of this law is important to all buyers and sellers of commercial fertilizers, a copy of the law is hereby inserted.

SEC. 2. Be it further enacted, etc., That it shall be the duty of any manufacturer or dealer in commercial fertilizers, before the same are offered for sale in this State, to submit to Commissioner of Agriculture a written or printed statement setting forth: First—the name and brand under which said fertilizer is to be sold, the number of pounds contained or to be contained in the package in which it is to be put upon the market for sale, and the name or names of the manufacturers, and the place of manufacture; Second—A statement setting forth the amount of the named ingredients which they are willing to guarantee said fertilizer to contain: (1) nitrogen, (2) soluble phosphoric acid, (3) reverted phosphoric acid, (4) insoluble phosphoric acid, (5) potash. Said statement, so to be furnished, shall be considered as constituting a guarantee to the purchaser that every package of such fertilizer contains not less than the amount of each ingredient set forth in the statement. This shall, however, not preclude the party making the statement from setting forth any other ingredient which his fertilizer may contain, which additional ingredient shall be considered as embraced in the guarantee above stated.

SEC. 3. Be it further enacted, etc., That every person proposing to deal in commercial fertilizers shall, after filing the statement above provided for, with the Commissioner of Agriculture, receive from the said Commissioner of Agriculture a certificate stating that he has complied with the foregoing section, which certificate shall be furnished by the Commissioner without any charge therefor.

That the said certificate, when furnished, shall authorize the party receiving the same to manufacture for sale, in this State, or to deal in this State in commercial fertilizers. That no person who has failed to file the statement aforesaid and to receive the certificate of authority aforesaid, shall be authorized to manufacture for sale in this State in commercial fertilizers. And any person so manufacturing for sale, in this State, or so dealing, without having filed the aforesaid statement, and received the certificate aforesaid, shall be liable for each violation to a fine not exceeding one thousand dollars, which fine shall be recoverable before any court of competent jurisdiction, at the suit of the Commissioner of Agriculture or of any citizen, and shall be disposed of as hereafter provided.

SEC. 4. Be it further enacted, etc., That it shall be the duty of the Board of Agriculture or its Commissioners, at the opening of each season, to issue and distribute circulars, setting forth the brands of fertilizers sold in this State, their analyses as claimed by their manufacturers or dealers, and their relative, and, if known, their commercial value.

SEC. 5. Be it further enacted, etc., That it shall be the duty of the Commissioner of Agriculture, under the regulations of the said Bureau, to cause to be prepared tags of suitable material with proper fastenings for attaching the same to packages of fertilizers, and to have printed thereon the word "guaranteed," with the year or season in which they are to be used and a fac-simile of the signature of said Commissioner. The said tags shall be furnished by said Commissioner to any dealer in or manufacturer of commercial fertilizers, who shall have complied with the foregoing provisions of this act, upon the payment by said dealer or manufacturer, to the said Commissioner, of fifty cents for a sufficient number of said tags to tag a ton of such commercial fertilizer.

SEC. 6. Be it further enacted, ete., That it shall be the duty of every person, befoie offering for sale any commercial fertilizers in this State, to attach or canse to be attached, to each bag, barrel or package thereof, one of the tags herein before described, designating the quantity of the fertilizer in the bag, barrel or package to which it is attached. Any person who shall sell or offer for sale, any package of commercial fertilizer which has not been tagged as herein provided, shall be deemed guilty of a misdemeanor, and on conviction thereof, shall be fined in the sum of two hundred and fifty dollars for each offense, and the said person shall be, besides, liable to a penalty of one hundred and fifty dollars for each omission, which penalty may be sued for either by the Commissioner of Agriculture or by any other person for the uses hereinafter declared. Any person who shall counterfeit or use a counterfeit of the tag, prescribed by this act, knowing the same to be counterfeited, or who shall use them a second time, shall be guilty of a misdemeanor, and on conviction thereof shall be fined in a sum not

exceeding five hundred dollars, one-half of which fine shall be paid to the informer, which fine may be doubled or trebled at each second or third conviction, and so on progressively, for subsequent convictions.

SEC. 7. Be it further enacted, etc., That all fertilizers or chemicals for manufacturing or composting the same, offered for sale or distribution in this State, shall have printed upon, or attached to each bag, barrel or package, in such a manner as the Commissioner of Agriculture may, by regulation, establish, the true analysis of such fertilizer or chemical as claimed by the manufacturer, showing the per cent of valuable ingredients such fertilizers or chemicals contain.

SEC. 8. Be it further enacted, etc., That the Commissioner of Agriculture may obtain, or cause to be obtained, at his discretion, fair samples of all fertilizers sold, or offered for sale in this State, from manufacturers or dealers, and shall have them analyzed by the official chemist, and shall publish the analysis for the information of the public.

SEC. 9. Be it further enacted, etc., That it shall be the duty of every person who sells a lot or package of commercial fertilizer, upon the request of the purchaser, to draw from same, and in the presence of the purchaser or his agent, a fair and correct sample, in such a manner as the Commissioner of Agriculture may, by regulation, establish.

SEC. 10. Be it further enacted, etc., That the copy of the official chemist's analysis of any fertilizer or chemical, certified to by him, shall be admissible as evidence in any court of this State, on the trial of any issue involving the merits of said fertilizer.

SEC. 11. Be it further enacted, etc., That the Bureau of Agriculture shall adopt needful rules and regulations providing for the collection of the money arising from the sale of tags, or from fines imposed under this act, and shall require the same to be deposited with the Treasurer of the State, and only to be drawn therefrom upon the warrants issued by the Auditor of the State upon the requisition of the Commissioner of Agriculture, made in pursuance of such rules and regulations; and the said Commissioner of Agriculture shall be entitled to receive no fees for collecting or disbursing said money, except his salary as provided for by law; but he shall be allowed a clerk at the salary to be fixed by the said bureau and be payable out of the fertilizer funds, and all sums of money arising from the provisions of this act shall be known as the "Fertilizer Fund," and shall be kept by the Treasurer separate from other public funds, and shall be exclusively used, as far as they may go, to defray the expenses of developing agriculture by making practical and scientific experiments in relation thereto.

SEC. 12. Be it further enacted, etc., That for the purpose of making practical and scientific tests or experiments, it shall be the duty of said Commissioner, subject to the approval of

GUARANTEED ANALYSES OF COMMERCIAL FERTILIZERS, AS RENDERED TO COMMISSIONER OF AGRICULTURE BY DEALERS AND MANUFACTURERS TO WHOM LICENSES HAVE BEEN ISSUED FOR SEASON 1886–87.

Name of Fertilizer or Chemical.	By Whom Reported.		By Whom Manufactured.	Where Manufactured.	Weight of Package.	Nitrogen.	Phosphoric Acid.			Potash.	Cash Price per ton to Farmers.
	Name.	Address.					Soluble.	Reverted	Insoluble		
Stern's Ammoniated	Stern's Fer. & Ch M'fg Co	14 Union St., New Orleans	Stern's Fert. & Chem. M'fg Co	New Orleans	200	2 to 3	6 to 8	3 to 4	...	3 to 3	$ 30.00
Stern's Pure Ground Raw Bone	" " " " "	" "	" " " " "	" "	200	$4\frac{1}{2}$ to $4\frac{3}{4}$	...	...	20 to 25	...	35.00
Acid Phosphate	" " " " "	" "	" " " " "	" "	200	...	14 to 18	1 to 3	...	...	16 to 25
Kainite	" " " " "	" "	Imported	Imported	200	...	...	...	...	13 to 14	12 to 14
Acid Phosphate	Wm. Garig & Co	Baton Rouge	Imported	England	150	...	15	5	2	...	...
Soluble Pacific Guano	W. P. Richardson	33 Carondelet St. N. O.	Pacific Guano Co., Boston	Charleston, S C. and Woods Hole, Mass.,	200	2 15 to 2.55	7 to 8.75	3 to 3.75	2 to 2.50	1 to 1.50	cot. grade
Soluble Pacific Guano	Rep. Glidden & Curtis Bos				200	2.40 to .3	$6\frac{1}{2}$ to 8	$2\frac{1}{2}$ to 4	2 to 3	$3\frac{1}{4}$ to $4\frac{1}{4}$	sug grade
Studniczkas' Standard Sugar Cane Fert	Henry Studniczka	41 North Peters St., N. O	Wahl Bros	Chicago, Ill	100	$2\frac{1}{2}$ to 3	9 to	11	1 to 2	...	30.00
Studniczkas' Standard Sugar Cane Fert	Henry Studniczka	" "	" "	" "	100	$2\frac{1}{2}$ to 3	9 to	11	1 to 2	$2\frac{1}{2}$	...
Gossypium Phospho	Geo. W. Scott M'fg Co	Atlanta, Georgia	Geo. W. Scott M'fg Co	Atlanta, Georgia	200	2.40 to 2.50	6 to $6\frac{1}{2}$	3.80 to 4	$1\frac{1}{2}$ to $2\frac{1}{2}$	$1\frac{1}{2}$ to $2\frac{1}{4}$	...
Scott's Best Acid Phosphate	" " "	" "	" " "	" "	200	...	$7\frac{1}{2}$ to $8\frac{1}{2}$	$4\frac{1}{2}$ to $5\frac{1}{2}$	$1\frac{1}{2}$ to $2\frac{1}{2}$	2 to $2\frac{3}{4}$	...
Scott's High Grade Acid Phosphate	" " "	" "	" " "	" "	200	...	8 to 9	5 to 6	2 to $2\frac{3}{4}$	...	...
Standard Home Mixture Guano	Meridian Fert. Factory	Meridian, Mississippi	Meridian Fertilizing Factory	Meridian, Mississippi	200	$2\frac{1}{4}$ to $2\frac{1}{2}$	$7\frac{1}{2}$ to 9	9 to 11	1 to 2	$2\frac{1}{4}$ to 3	...
Bone and Potash	" " "	" "	" " "	" "	200	...	8 to 10	10 to 13	1 to 2	$2\frac{1}{4}$ to 3	...
Chalmette Mills Fertilizer	W. A. Ober, Agent	197 Gravier St., N. O.	G Ober & Sons Co	Cor Adams & S Peters St N. O	125	2 to $3\frac{1}{2}$	4 to 5	$3\frac{1}{2}$ to $4\frac{1}{2}$	$1\frac{1}{4}$ to $1\frac{3}{4}$	2 to 3	...
Sugar Fertilizer	Planters Fert. M'fg Co	111 Magazine St, N. O.	Planters Fertilizing M'fg Co.	New Orleans	100	3.5 to 4.	7 5 to 9	...	...	2 to 3	22.50
Cotton Fertilizer	" " " "	" "	" " " "	" "	100	3	10	...	...	2	22.50
Atlantic Fertilizer	Pelzer Rodyers & Co	Charleston, S. C	Atlantic Phosphate Co	Charleston, S. C	200	2.05	6.50	1.50	1.50	2	...
Armour Bone Meal	H. Studniczka	41 North Peters St., N. O	Armour & Co	Chicago, Ill	100	4 to 5	...	...	25 to 28	...	28.00
Standard Cotton and Sugar Guano	Haynes & Rodgers	101 Poydras St., N. O.	Farmers Fertilizing Co.	Syracuse, New York	200	1 to 2	8 to 9	...	3 to 4	4 to 6	...
Armour Hog Tankage	H. Studniczka Sole Agt.	41 North Peters St., N. O	Armour & Co.	Chicago	100	8 to 9	...	...	12 to 15	...	26.00
Acid Phosphate	Planters Fertilizing Co	111 Magazine St., N. O.	Imported	England	150	...	15–16	.5	.2	...	18.00
Kainite	" " "	" "	Imported	Germany	...	...	...	...	...	12 to 14	10.00

said Bureau, to enter into contracts specifying the duration and conditions thereof with a competent chemist and expert in experimental agriculture, to perform the duties of official chemist and to carry on and to conduct the experiment station established by said Bureau at Baton Rouge; and with the Louisiana Scientific Agricultural Association, having an experiment station in the Parish of Jefferson, and in making such contracts, the said Commissioner shall provide that experiments be made for the development and benefit of agriculture, especially in relation to the standard crops of the State, such as cotton, sugar, rice, corn, the cereals and grasses, and the like.

SEC. 13. Be it further enacted, etc., That as compensation for the conduct of such experiments the Commissioner of Agriculture be and he is hereby authorized to apply the net result from the sale of tags, and from fines or penalties imposed for violations of the terms of this act, to the two said stations, and, if necessary, parts of other sums that may be appropriated by law, and subject to the control of himself or said Bureau; provided, That said contract shall not give more than one-half of the of the result of the sale of tags, and fines, to any one said stations; and provided further, That the said stations undertake to perform for and on behalf of the Commissioner of Agriculture, under such regulations as may be agreed on, all analyses required under this act free of any charge whatsoever.

SEC. 14. Be it further enacted, etc., That the Director of the State Experiment Station shall be considered as the official chemist of the Bureau of Agriculture. He shall also attend such chemical and agricultural conventions as may be necessary; the traveling expenses incident to such attendance shall be chargeable and collectable from the revenues derived from the sale of tags.

SEC. 15. Be it further enacted, etc., That the Commissioner of Agriculture shall keep a correct and faithful account of all tags received and sold by him, showing the number sold, to whom sold, and, as far as practicable, for what fertilizers they were intended to be used, and the amount of money collected therefor, and all money arising from fines, under this act.

SEC. 16. Be it further enacted, etc., That the terms "commercial fertilizers," or "fertilizers," where the same are used in this act shall not be held to include lime or land plaster, cotton seed meal, ashes or common salt, or raw bone, not specially treated.

Only cotton seed meal, land plaster, salt ashes, lime and bones, not specially treated, are exempt from the provisions of this law.

The following manufacturers and dealers having complied with the law, have been licensed to deal in commercial fertilizers in this State.

EXPLANATION OF ANALYSES.

Nitrogen, Phosphoric Acid and Potash, are the three ingredients which give value to commercial fertilizers, and are the only ones determined in official analyses.

Nitrogen is the most costly as well as the most valuable fertilizing ingredient. It occurs as Organic Nitrogen in animal and vegetable matters—easily decomposed and quickly available in blood and meat, slowly disintegrated and of doubtful value in leather or peat unless specially treated.

All Organic Nitrogen is first converted into Nitric Acid or Ammonia in the soil or compost heap, before it can be used by plants. Nitric Acid and Ammonia are furnished in commerce, the one in the forms of Nitrates of Soda and Potash, the other as Sulphate of Ammonia.

Soluble Phosphoric Acid refers only to such phosphates that are soluble in pure water and is made by treating bones, bone ash, bone black, or mineral phosphate with sulphuric acid. It is the chief ingredient of Acid Phosphates, Superphosphates or Dissolved Bones.

By Reverted Phosphoric Acid, reference is made to that form of Acid, which, though insoluble in water is freely soluble in certain salts, particularly Citrate of Ammonia.

Insoluble Phosphoric Acid refers to that form that is soluble only in Acids.

Potash is the ingredient usually found in ashes, and should be soluble in water.

VALUATION OF FERTILIZERS.

The commercial value of a Fertilizer is regulated by the prices demanded in commerce for the different forms of the three ingredients, Nitrogen (Ammonia) Phosphoric Acid and Potash. These prices fluctuate according to the demand and supply. In the North, Nitrogen is assigned a separate valuation for each of the forms—that in Nitrates and Ammonia Salts receiving the highest figure, and that in leather and peat, the lowest.

In Connecticut or Massachusetts, a determination of the forms in which this ingredient occurs must be made before its commercial value can be calculated. All the forms of Nitrogen

have heretofore been considered of equal money value in the South and but one price assigned. This of course precludes the existence of Nitrogen in the form of leather dust, or powdered horn, forms regarded as unavailable and of little money or agricultural value.

The soluble and reverted forms of Phosphoric Acid have together been styled as "available" and assigned one value. The insoluble Phosphoric Acid has received no valuation. All forms of Potash soluble in water have been regarded as of equal value.

At a convention of Southern State Chemists, held at Athens, Ga., in 1886, the following tariff of prices was adopted:

Ammonia, 16 cents per pound.

Nitrogen, 19½ cents per pound.

Soluble Phosphoric Acid. 7½ eents per pound.

Reverted Phosphoric Acid, 7½ cents per pound.

Potash, (Soluble in water) 5 cents per pound,

The writer though not present at the convention, deems it best, for the sake of harmony in State valuations, to adopt this tariff for the present year, though he wishes to dissent from the opinion that reverted Phosphoric Acid is of equal value as the soluble form, or that Nitrogen is of same money value in all its forms.

The above are commercial values, that is what these ingredients, properly mixed and sacked can be purchased for in the markets of the South. The above tariff when appplied to fertilizers bought in New Orleans, will be found to give values beyond their actual selling prices. For example, good cotton seed meal contains 7 per cent. Nitrogen, 3 per cent. Phosphoric Acid, ond 2 per cent. Potash, neglecting the Phosphoric Acid and Potash, and estimating its value only on its content of Nitrogen, there will be obtained for one ton 140 lbs of Nitrogen@19½ cents—$27.30. It is well known that this Fertilizer could be bought at any time in the year in New Orleans for less than $20 per ton.

This form of Nitrogen comes entirely from the South, while all others are products of Northern or foreign climes. Home consumption takes only a small portion of the output of our mills, the greater part finding its way to the North and Europe.

This export demand regulates the price, and hence we have the cheapest form of Nitrogen presented to us in our own home product, viz.: Cotton Seed Meal.

By applying the above to a Fertilizer of known composition and comparing the result with the actual selling price, the consumer can easily tell whether he is getting value received.

HOW TO COMPUTE THE VALUE OF A FERTILIZER.

A fertilizer is purchased whose guaranteed analysis recorded on the sack is as follows:

Nitrogen, 3 per cent.
Soluble Phosphoric Acid, 6 per cent.
Reverted Phosphoric Acid, 4 per cent.
Potash, 2 per cent.

What is its commercial value?

IN ONE TON WE HAVE

3 per cent Nitrogen	60 lbs	@ $19\frac{1}{2}$ cts	$11.70
6 per cent Soluble Phosphoric Acid	120 lbs	@ $7\frac{1}{2}$ cts	9.00
4 per cent Reverted Phos. Acid	80 lbs	@ $7\frac{1}{2}$ cts	6.00
2 per cent Potash	40 lbs	@ 5 cts	2.00
Commercial value per ton			$28.70

Fy comparing the above with the amount paid, the consumer ean easily calculate whether he has paid too much.

CLASSIFICATION OF FERTILIZERS.

The following have been analyzed at the Station since its inauguration:

Acid Phosphates	21
Ammoniated Superphosphates and Guanos	37
Special Manures	6
Cotton Seed Meal	9
Kainite	4
Tankage	5
South Carolina Floats	1
Bone Black	1
Ground Bone	1
Phosphate Meal	1
Cotton Hull Ashes	1
Nitrate of Soda	1
Rice Hull Ashes	1
Tobacco Stems	2
Rotten Bagasse	1
Rice Bran as Fertilizer	1
Rice Bran as Mule Feed	2
Rice Polish as Mule Feeed	2
Bat Manure	1
Total Analyses	98

Besides above 16 analyses have beeen made for private parties and are not published herein.

ACID PHOSPHATES.

(Phosphoric Acid the only valuable ingredient.)

Station No. 3—Etiwan Acid Phosphate, presented to Station by Etiwan Co., Charleston, S. C.
Station No. 4—Stono Dissolved Bones, presented to Station by Jno. T. Moore & Co., New Orleans.
Station No. 5—Stono Acid Phosphate, presented to Station by Jno. T. Moore & Co., New Orleans.
Station No. 6—Acid Phosphate, bought of Chalmette Mills, New Orleans, for use of Station.
Station No. 10—Dissolved Bone, manufacturəd for Station by Stern's Fertilizing Co. New Orleans.
Station No. 26—English Acid Phosphate, from Planters' Fertilizer Co., sampled by Station.
Station No. 48—English Acid Phosphate, from Planters' Fertilizer Co., sampled by D. R. Calder.
Station No. 59—Acid Phosphate, sent by Leonce Soniat, Iberville Parish.
Station No. 60—Acid Phosphate, sent by McCall Bros., Donaldsonville, La.
Station No. 62—German Acid Phosphate, sent by A. A. Maginnis, New Orleans.
Station No. 64—Wando Acid Phosphate, sent by T. P. Hutchinson.
Station No. 65—Atlanta Soluble Bone sent by T. P. Hutchinson.
Station No. 70—Superphosphate, sent by A. A. Maginnis, New Orleans.
Station No. 71—Acid Phosphate, sent by A. A Maginnis, New Orleans.
Station No. 72—Acid Phosphate, sent by A. A. Maginnis, New Orleans, La.
Station No. 76—Acid Phosphate, sent by D. R. Calder, New Orleans, La.
Station No. 77—Superphosphate sent by D. R Calder, New Orleans, La.
Station No. 78—Superphosphate sent by D. R. Calder, New Orleans, La.
Station No 100—Acid Phosphate, sent by McCall Bros., Donaldsonville, La.
Station No 103—Acid Phosphate, sent by Leon Godchaux, New Orleans, La.
Station No. 113—Kainite sampled by Department of Agriculture from a lot imported by Planters' Fertilizer Company, New Orleans, La.

ACID PHOSPHATES.

Analyses.

Station Number.	Soluble Phosphoric Acid.	Reverted Phosphoric Acid.	Insoluble Phosphoric Acid.	Total Phosphoric Acid.	Relative Commercial value per ton of 2000 lbs.
3	8.06 p. c.	5.92 p c	.32 p c	14.30 p c	$ 20.97
4	10.75	1.82	1.63	14.20	18.85
5	7.20	2.09	1.85	11.14	13.93
6	9.02	5.28	2.02	16.32	21.45
10	14.15	,34	.10	14.59	21.73
26	11.14	4.38	.03	15.55	23.28
48	14.02	1.15	.19	15.36	22.75
59	12.29	.86	.29	13.44	19.72
60	14.21	1 34	.19	15.74	23.32
62	....	8.96	9.28	18.24	13.44
64	9.79	4.42	2.11	16.32	21.31
65	9.02	2.94	3.21	15.17	17.94
70	13.44	·27	.48	14.19	20.56
71	1.92	4.77	.99	7.68	10.03
72	....	8.48	1.31	9.79	12.72
76	13.06	1.92	.38	15.36	22.47
77·	16.88	1.40	.26	18.54	27.42
78	14.21	.98	.51	15.70	22.78
100	13.06	2.23	·.45	15.74	22.93
104	12.86	1.89	.03	14.78	22.12
113	13.44	1.35	.19	14.98	22.18

AMMONIATED SUPERPHOSPHATES AND GUANOS.

These are Acid Phosphates mixed with some form of Ammonia, with or wihout Potash; when the latter is present they are usually styled "*complete* manures."

Station No. 12—Guano, sent by Hon. Duncan F. Kenner, New Orleans, La.
Station No. 18—Guano, sent by McCall Bros., Donaldsonville, La.
Station No. 19—Cane Fertilizer, sent by J. C. Morris, New Orleans, La.
Station No. 22—Sugar Cane Fertilizer, sent by H. Studniczka, New Osleans, La.
Station No. 27—Guano, sent by J. C. Morris, New Orleans, La.
Station No. 28—Guano, sent by D. F. Kenner, New Orleans, La.
Station No. 29 –Guano, sent by D. F. Kenner, New Orleans, La.
Station No. 30—Planters' Fertilizer, sent by A. A. Maginnis, New Orleans, La.

Station No. 35—Soluble Pacific Guano, sent by Leon Godchaux, New Orleans, La.

Station No. 36—Planters' Fertilizer, sent by Leon Godchaux, New Orleans, La.

Station No. 37—Planters' Fertilizer sent by A. A. Maginnis, New Orleans, La.

Station No. 38—Guano, sent by D. R. Calder, New Orlean, La.

Station No. 39—Planters' Fertilizer, sampled by Station.

Station No. 46—Planters' Fertilizer, sampled by Station.

Station No. 52—Guano sent by J. C Murphy, New Orleans, La.

Station No. 55—Studniczka's Sugar Cane Special, sent by Leon Godchaux, New Orleans.

Station No. 58—Studniczka's Sugar Cane, sent by H. Studnczka, New Orleans, La.

Station No. 63—Stern's Sugar Goods, sent by Hon. Ed. J. Gay, New Orleans, La.

Station No. 67—Chalmette Guano sent by Ed. Scanel, New Orleans, La.

Station No. 68—Chalmette Guano, sent by Ed. Scannel, New Orleans, La.

Station No. 74—Guano, sent by J. Peters, St. Martinsville, La.

Station No. 75—Guano, sent by J. Peters, St. Martinsville, La.

Station No. 80—Eureka Guano, sent by T. D. Miller & Co., New Orleans, La.

Station No. 82—Guano, sent by T. D. Miller & Co., New Orleans, La.

Station No. 84—Guano, sent by J. C. Morris, New Orleans, La.

Station No. 91—Guano, sent by McCall Bros., Donaldsonville, La.

Station No. 92—Guano, sent by T. D. Miller & Co., New Orleans, La.

Station No. 98—Guano, sent by Emile Legendre, Terre Haute, La.

Station No. 101—Soluble Pacific Guano, sent by McCall Bros., Donaldsonville, La.

Station No. 102—Stern's Fertilizer, sent by McCall Bros., Donaldsonville, La.

Station No. 105—Fertilizer sent by T. D. Miller & Co., New Orleans, La.

Station No. 106— " " " " " " " "

Station No. 107— " " " " " " " "

Station No. 111—Sugar cane fertilizer, sampled by Department of Agriculture from 50 tons made by Planters' Fertilizer Company, New Orleans.

Station No. 112—Cotton fertilizer, sampled by Department of Agriculture from 7 tons made by Plan7ers' Fertilizer Company, New Orleans.

Station No. 115—Soluble Pacific Guano, cotton goods, sampled by Department of Agriculture, from 300 tons in hands of W. P. Richardson, Agent, New Orleans, made by Pacific Guano Company, Woods Hole, Mass.

Station No. 116—Soluble Pacific Guano, cane goods, sampled by Department of Agriculture, from 60 tons in hands of W. P. Richardson, Agent, New Orleans, made by Pacific Guano Company, Woods Hole, Mass.

AMMONIATED SUPERPHOSPHATES AND GUANOS.

Analyses.

Station Number.	Nitrogen.	Equivolent to Ammonia.	Soluble Phosphoric Acid.	Reverted Phosphoric Acid.	Insoluble Phosphate Acid.	Total Phosphate Acid.	Potash.	Relative Commercial value per ton
12	1.19	1.44	8.45	3.36	2.20	14.01	1.27	$23.10
18	2.66	3.23	4.03	1.10	.05	5.18	1.41	19.44
19	2.52	3.06	5.95	4.61	1.92	12.48	....	25.63
22	2.59	3.15	4.99	5.89	2.17	13.05	....	26.40
27	3.22	3.91	5.38	2.27	.03	7.68	3.22	27.20
28	3.22	3.91	5.18	4.87	1.47	11.52	....	27.58
29	3.15	3.83	5.18	5.19	1.15	11.52	....	27.81
30	3.64	4.42	5.95	1.99	.51	8.45	1.89	27.94
35	3.15	3.83	8.06	1.51	2.72	12.29	2.64	29.24
36	3.43	4.17	5.76	2.95	.51	9.22	1.95	28.35
37	3.57	4.34	6.72	2.40	.29	9 41	1.97	29.54
38	3.50	4.25	1.34	2.46	.23	4.03	2.05	21.35
39	3.43	4.17	6.14	2.34	.35	8.83	1.75	27.81
46	3.50	4.25	5.95	2.63	.44	9.02	2.02	28.49
52	2.94	3.57	4.42	3.19	1.41	9.02	2.66	25.49
55	3.33	4.04	5.57	5.19	2.68	13.44	....	29.07
58	2.52	3.06	4.99	5.66	1.05	11.70	....	25.76
63	2.73	3.32	7.49	2.18	2.62	12.29	2.26	27.38
67	3.22	3.91	2.69	3.84	.58	7.11	2.62	24.92
68	3.36	4.08	3.84	2.40	.67	6.91	2.70	25.12
74	3.36	4.08	4.80	3.84	.38	9.02	2.51	28.53
75	3.22	3.91	4.80	1.86	1.79	8.45	2.80	25.30
80	1.96	2.38	9.22	.44	3.17	12.83	1.40	23.51
82	4.20	5.10	......	5.00	2.10	7.10	.90	24.72
84	3.43	4.17	7.10	1.60	.32	9.02	1.70	28.09
91	2.94	3.57	4.03	1.47	.45	5.95	.79	20.46
92	3.36	4.08	5.95	2.31	.59	8.84	1.67	27.12
98	2.10	2.55	3.84	6.17	1.90	11.91	... .	23.17
101	2.45	2.98	7.68	2.12	3.26	13.06	2.61	26.85
102	2.52	3.06	6.52	5.15	.62	12.29	2.02	29.31
105	3.36	4.08	4.42	3.32	2.24	9.98	3.03	27.69
106	2.59	3.14	5.18	.58	.77	6.53	.96	19.64
107	2.17	2.63	5.57	2.43	2.75	10.75	2.08	22.49
111	3.62	4.40	6.95	1.05	.26	8 26	2.29	28.37
112	3.22	3.91	7.30	2.17	.13	9.60	1.93	28.64
115	2.28	2.77	7.49	3.20	2.56	13.25	1.83	26.72
116	3.22	3.91	7.68	1.35	3.07	12.10	3.38	29.44

SPECIAL MANURES.

These are manures prepared for some special crop by formulas furnished the manufacturer.

Station No. 25—Fruit and Vegetable, Special, sent by H. Studnezka, New Orleans, La.

Station No, 53—Stern's Vegetable Manure, sent by J. C. Morris, New Orleans, La.

Station No. 93—Cane, Special; prepared by Planters' Fertilizer Co., according to following formula: 800 lbs Acid Phosphate, 600 lbs Cotton Seed Meal, 600 lbs Land Plaster.

Stations Nos. 96 and 97—Cane, special, prepared by Stern's Fertilizer Co., for Gov. H. C. Warmoth, Lawrence, La., according to formula: 3 parts Cotton Seed Meal, 1 part Acid Phosphate.

Station No. 109—Cane, special, prepared by Planters' Fertilizer Company, New Orleans, for Gen. J. L. Brent, New River, La., according to formula, 3 parts cotton seed meal and one part of Acid Phosphate.

SPECIAL MANURES.

Analyses.

Station Number.	Nitrogen.	Ammonia.	Soluble Phosphoric Acid.	Reverted Phosphoric Acid.	Insoluble Phosphoric Acid.	Total Phosphoric Acid.	Potash.	Relative Commercial Value per ton
25	6.37	7.74	......	8.99	5.03	14.02	....	$38.20
53	3.22	3.91	3.26	6.09	1.21	10.56	7.03	33.56
93	2.35	2.85	5.76	.45	.13	6.34	.60	19.03
96	5.25	6.38	3.84	.22	.54	4.60	1.50	28.01
97	5.18	6.29	3.65	.89	.26	4.80	1.48	28.42
109	4.62	5.61	3.26	2.79	.38	6.53	1.50	28.52

COTTON SEED MEAL

Is largely used in Louisiana as a manure. Being a *feed stuff*, it is excluded from the provisions of the Fertilizer Law. Hence, in its purchase care should be exercised to see that it is free from hulls, which are sometimes found in it to the extent of 30 per cent or more, of its weight, thus greatly lowering its value. This mixture is sometimes intentional and sometimes accidental; in the latter case arising from defective machinery. Occasionally a dark colored meal is found on the market, made from injured seed. This meal though perhaps objectionable as cattle food, is fully the equal of the bright kind as a manure The price of Cotton Seed Meal in New Orleans during the past year has been from $17 to $20 per ton. Its commercial value reckoned by our tariff is far ahead of its actual value, showing it to be the cheapest form of Nitrogen offered to the Southern planter.

Station No. 2—Cotton Seed Meal, sent by J. C. Morris, New Orleans.
" " 11— " " " " " " " "
" " 13— " " " " " " " "
" " 23— " " " " " D. F. Kenner, " "
" " 57— " " " " " J. C. Morris, " "
" " 61— " " " " " L. S. Clarke, Pattersonville.
" " 81— " " " " " D. F. Kenner, New Orleans.
" " 83— " " " " " J. C. Morris, " "
" " 99— " " " " " D. Thompson, Calumet Plantation.

COTTON SEED MEAL.

Analyses.

Station Number.	Nitrogen.	Ammonia.	Phosphoric Acid.	Potash.
2	6.16	7.48	3.32	1.98
11	7.28	8.84	3.32	1.70
13	7.42	9.01	3.25	1.55
23	6.51	7.91	3.16	1.84
57	6.51	7.91	3.16	1.84
61	6.44	7.82	*	*
81	7.15	8.68	3.20	1.74
83	6.16	7.48	3.45	1.45
99	7.14	8.67	3.29	1.22

*Not determined.

KAINITE

Is a crude form of German Potash Salts, taken from the mines of Stassfurth or Leopolshall, and contains usually about 12 per cent Potash. It has besides a goodly amount of Magnesic and Sodic Chlorides.

Station No. 21—Kainite sent by A. A. Maginnis, New Orleans.
" " 54— " " " D. R. Calder, New Orleans.
" " 87— " " " J. C. Morris, New Orleans.
" " 114—Kainite, sampled by Department of Agriculture from a lot imported by Planters' Fertilizer Company, New Orleans, La.

KAINITE.

Analyses.

Station Number.	Potash.	Commercial Value Per Ton
21	11.92	$11.92
54	13.12	13.12
87	11.90	11.90
114	12.55	12.55

TANKAGE

Is the refuse of slaughter houses, including blood, spoiled meat, bones, etc., all dried and finely pulverized. Its composition is very variable, and it should be purchased only on guaranteed analysis.

Station No. 33.—Tankage sent by Jno. T. Moore & Co., New Orleans, La.
" " 34.—Blood and Bone, sent by Leon Godchaux, New Orleans, La
" " 49.—Tankage, sent by L. S. Clarke & Bro., Pattersonville, La.
" " 50.— " " " " "
" " 51—Blood and Bone, sent by Leon Godchaux, New Orleans, La.

TANKAGE.

Analyses.

Station Number.	Nitrogen.	Ammonia.	Total Phosphoric Acid.
33	6.16	7.48	11.90
34	6.37	7.74	14.59
49	3.64	4.42	24.58
50	5.74	6.97	14.78
51	3.78	4.59	15.74

The tariff of prices prescribed by the Southern convention gives no valuation to the insoluble form of Phosporic Acid, hence no commercial value can be assigned the above. Phosphoric Acid in Bone is however, worth about five cents per pound.

SOUTH CAROLINA FLOATS.

Station No. 7—Etiwan Floats donated to Station by Etiwan Phosphate Co., Charleston, S. C.

ANALYSIS.

Phosphoric Acid..26.69 per cent

This goods is made from the Charleston rock by grinding with rollers into such an impalpable powder that it "floats" in the air, hence its name. Having never been treated with acid, its Phosphoric acid is, of course, insoluble.

BONE BLACK.

After use in the sugar refinery, is often treated with acid to render it soluble. Without this treatment it is very slow in its action as a manure, the charcoal particles enveloping the phosphate of lime, prevent the decomposition of the latter.

Station No. 20—Sent by Wm. B. Schmidt, New Orleans, contained—
Phosphoric Acid .... 33.93 per cent

GROUND BONE

Is highly prized in the North as a fertilizer, especially for grass crops. In the South, unless on soils, rich in humus, it is very slow of action.

Station No. 24—Sent by H. Studniczka, New Orleans, contained
Nitrogen .... 4.62 per cent
Phosphoric Acid .... 22.88 " "

PHOSPHATE MARL.

A ton of Phosphate Marl was sent to the Station by the Meridian Fertilizing Company, Miss., for field tests. This marl is made from the phosphatic green sands of Alabama, and contained 2.50 per cent of Phosphoric Acid.

COTTON HULL ASHES.

Are in large demand in Connecticut for growing tobacco, and command high prices. In the South they are not held in high esteem. They are not uniform in composition; the light colored being always richer in Potash than the dark colored. They are chiefly valuable for their large content of Potash. They contain also a goodly per centage of Phosphoric Acid.

Station No. 31—Sent by J. C. Morris, New Orleans, La., contained—
Phosphoric Acid .... 10.18 per cent
Potash .... 20.69 per cent

NITRATE OF SODA.

Station No. 104—Sent by Gen. J. L. Brent, New River, La., contained Nitrogen, 16.4 per cent, equal to Nitrate Soda 99.6 per cent

RICE HULL ASHES.

upon the moisture freed sample.

Station No. 73—Sent by Adam Thompson, New Orleans, La., contained—
Silica .... 94.45 per cent
Phosphoric Acid .... 1.14 per cent
Potash .... 1.82 per cent
Showing its low value as a fertilizer.

TOBACCO STEMS.

Station No. 85—Pure Stems.
" " 86—Stems dipped in lye.
Were both sent by Mr. Adam Thompson, New Orleans.

	Nitrogen	Phosphoric Acid	Potash.	Ash
No. 85	189	75	4.05	19.21
No. 86	....	96	4.05	23.67

The commercial value of above is about $10 per ton.

ROTTEN BAGASSE.

Station No. 56—Sent by Henry Studniczka, New Orleans, contained

Water	25.95	per cent
Nitrogen	1.51	" "
Phosphoric Acid	.46	" "
Potash	.19	" "

This would indidate a value of over $5.00 per ton.

RICE BRAN.

Has been considered by some planters as having a high fertilizing value.

Station No. 95—Sent by Lucien Soniat, Jefferson Parish, La., gave

Nitrogen	1.40	per cent
Phosphoric Acid	1.76	" "

Applying the tariff of prices its commercial value as a fertilizer would be about $8 per ton. It is worth far more as as a feed stuff, as the proximate analyses given further on will show.

Two samples each of Rice Bran and Rice Polish were received from Mr. W. B. Bloomfield of New Orleans, with request that they be analysed and an opinion given of their adaptibility as a mule feed. Accompanying the analyses were the following remarks.

In the analysis of all "feeding stuffs," certain proximate principles are determined, viz.: Albuminoids, Carbohydrates, Fat, Cellulose and Ash. These differ both in their chemical composition and in their physiological action.

Albumunoids rank highest in importance in animal nutrition and are useful in animal economy for making muscles, tissues, tendons, nerves, etc., and in the absence of other ingredients may serve as fuel and fat. True Carbohydrates, consisting of Starch, Sugars, Gum, etc., perform their chief function in giving heat to the animal system. *Fats* may produce fat, or be consumed like true carbohydrates in generating heat. *Cellulose*

is for the most part indigestible, and takes but little part in animal nutrition. When any part of it is digestible its action is similar to carbohydrates. The Albuminoids are to the animal system, what brass and iron are to the machine, the materials of construction and repair. The Carbohydrates represent in animals, what fuel does to the engine. The oxidation of the Carbohydrates in the blood maintains life and runs the animal machine, while the steam engine derives its power from the consumption of coal or wood. There is, however, one characteristic difference between a steam engine and animal. The former stops for repairs when needed, the latter is stopped only by death, and its repairs must go on simultaneously with its wastes. Therefore it must be fed upon two kinds of food, one to furnish heat and to run life, the other to repair the wastes of muscle and tissue, and both must go on at same time. Could a steam engine be fed with coal, water, brass and iron, and be made to run and make repairs, at same time consuming its worn out parts and voiding them as smoke and ashes, we would have similar action to that constantly going on in every living being. The Albuminoids are thus consumed along with carbohydrates. The former may, however, in the absence or deficiency of the latter, act as fuel and even make fat. However, economy would always suggest an abundance of Carbohydrates in every ration, rather than consume needlessly the more costly Albuminoids. They ought to perform distinct offices in animal nutrition, and science has decided that they should exist in a ration in certain proportions. This ratio of digestible Albuminoids to digestible Carbohydrates is styled the "nutritive ratio," and has been determined with great care by Experiment Stations for most of our domestic animals. The digestibility of certain "feed stuffs" has also been carefully determined by experiments. No experiments have been made upon the digestibility of rice bran or polish, but we can assume without much error that they are similar to *wheat bran and shorts*, which are very digestible. The nutritive ratio of these feed stuffs would then be—

For Rice Bran No. 1 .... 1—5.6
For Rice Bran No. 2 .... 1—6.3
For Rice Polish No. 1 .... 1—6.7
For Rice Polish No. 2... 1—5.8
For Wheat Bran .... 1—4.4

Below are analyses of the Rice Bran and Polish, and also of Wheat Bran, which is given for comparison.

	Rice Bran No. 1	Rice Bran No. 2	Rice Polish No. 1	Rice Polish No. 2	Wheat Bran
Water	9.96	9.56	9.00	9.33	13.1
Organic Matter	80.78	81.62	83.63	79.37	81.5
Ash	9.26	8.82	7.37	11.3	5.4
	100.00	100.00	100.00	100.00	100.00
Albuminoids	13.56	11.81	11.37	11.38	14.
Carbohydrates	49.32	50.46	59.91	45.55	50.
Cellulose	7.00	9.85	5.86	14.45	17.8
Fat	10.90	9.50	6.50	8.00	3.8
Nutritive Ratio	1–5.6	1–6.3	1–6.7	1–5.8	1–4.4

The high ash percentages, almost equalling those of hulls of wheat, and rye, and equal to those of peas and beans, are striking.

The fat too is very high. As a mule feed it will not do alone. Its value in combination with other food will depend largely upon its digestibility and palatability. A horse or mule moderately worked will require every twenty-four hours for every 1,000 lbs weight, 22.5 lbs of organic substances—1.8 lbs albuminoids, 11.2 lbs carbohydrates, .6 lb fat, with a nutritive ratio of 1 to 7. By combining with crab grass hay or pea vine hay, we can get a ration supplying the demands. Crab grass hay has the following composition:

Albuminoids, 7 per cent; Carbohydrates, 40 per cent; Fat, 2 per cent, and 80 per cent Organic Matter. Of this, about 56 per cent of the Albuminoids, 63 per cent of the Carbohydrates, and 48 per cent of the Fat are digestible.

Pea vine hay has approximately the following composition:

Albuminoids, 14-15 per cent; Carbohydrates, 45 per cent; Fat, 3.5 per cent, and about 90 per cent of organic matter. Of this, 60 per cent of the Albuminoids, 69 per cent of the Carbohydrates, and 59 per cent of the Fat are digestible.

Combining first with crab grass hay, we have—

	Organic Matter	Albuminoids	Carbohydrates	Fat
10 lbs Rice Bran No. 1—	8.07	1.3	5.	.6
18 lbs Crab Grass Hay—	14.50	.7	7.4	.17
Total	22.57	2.0	12.4	.77
Amount required	22.50	1.8	11.5	.6

Or with Pea Vine Hay,

10 lbs Rice Bran No. 1—	8.07	1.3	5.	.6
14 lbs Pea Vine Hay	12.60	1.96	3.30	.49
Total	20.67	3.26	8.30	1.09
Amount required	22.20	1.8	11.50	.6

Here we have an excess of Albuminoids and Fats, and deficiencies in Organic matter and Carbohydrates, which could easily be supplied by straw of any kind. But in these we have made no allowance for digestibility. But should the average mule be fed ten to twelve lbs of good unfermented rice bran or polish, with eighteen pounds of crab grass hay or 14 of pea vine hay, good work may be expected. A reduction of one-half of the bran and the substitution of an equal weight of corn, will, however, be better adapted to to the taste and requirements of a working mule. Rice bran or polish can be successfully used in farm economy, if used with prudence and precaution.

BAT MANURE.

The U. S. Barracks recently donated to the Louisiana State University and A. and M. College, has long been the undisturbed abode of quantities of bats. In making the necessary repairs, there was found a large amount of the manure of this bird, from one building alone as much as 10 tons (estimated).

This manure was analyzed by B. B. Ross, Professor of Chemistry in the A. & M. College, who reports the following results:

ANALYSIS OF BAT MANURE FOUND IN THE TEXAS BUILDING OF THE GARRISON GROUNDS, NOW THE PROPERTY OF LOUISIANA STATE UNIVERSITY AND A. & M. COLLEGE.

Soluble Phosphoric Acid	2.37 per cent
Reverted " "	1.24 per cent
Insoluble " "	0.45 per cent
Nitrogen	8.75 per cent
Ammonia	10.62 per cent
Potash	1.39 per cent
Commercial value per ton	$40.78

The excellent results accruing from an application of this manure, to vegetables, grasses, clovers, etc., fully corroborate the chemical analysis above.

SUGAR CANE.

SUGAR HOUSE AND LABORATORY EXPERIMENTS—1886

BULLETIN No. 10

OF THE

LOUISIANA SUGAR EXPERIMENT STATION

Wm. C. Stubbs, Ph. D.,

—DIRECTOR—

KENNER, LA.

—ISSUED BY—

THOMPSON J. BIRD,

COMMISSIONER OF AGRICULTURE, BATON ROUGE, LA.

BATON ROUGE:

PRINTED BY LEON JASTREMSKI, STATE PRINTER,

1887.

SUGAR EXPERIMENT STATION,
Kenner, La.

Major T. J. Bird, Commissioner of Agriculture, Baton Rouge, La.:

Dear Sir—I herewith hand you Bulletin No. 10, covering experiments in the Sugar House and Laboratory on Sugar Cane and its products made in the closing months of 1886. The immense amount of labor required in the preparation of this Bulletin from Laboratory and Sugar House notes made during grinding, together with the pressure of current duties have prevented its earlier appearance.

Respectfully,

WM. C. STUBBS, Director.

The sugar planter of Louisiana is both an agriculturist and a manufacturer. He grows the cane and then manufactures it into sugar and molasses. Therefore to attain the most beneficial results, a Sugar Experiment Station should conduct experiments in the field, laboratory and sugar house. Agriculture, chemistry and mechanics are the sciences which must contribute to the successful prosecution of the sugar industry.

Realizing this fact, this Station, after a careful inauguration of a series of field experiments, and the establishment of a well appointed laboratory, proceeded to the equipment of a sugar house. There was found on the station, a small sugar house, with a three roller mill 24x14 inches, fed by hand, a boiler, an engine, a series of open kettles, wooden coolers, &c. The open ketties were rejected, together with the unnecessary coolers, &c. The engine, boiler and mill were overhauled, repaired and used. A sulphur machine was erected; juice boxes, each large enough for a single experiment, were placed in proper positions, into which a juice pump (monte jus) conveyed the juice from the sulphur box; an improved clarifier, capacity 70 gallons, with a settling tank of three compartments of 150 gallons each; two small brushing pans, with another settling tank of same size and form as one just mentioned, were the vessels used for clarification and preparing the juice for concentration. A Yaryan's vacuum distilling apparatus was used to concentrate the juices for the strike pan. This apparatus had the capacity of concentrating in vacuo 150 gallons per hour, from 7° B. to 30° B., and as far as we can judge from experiments made (nearly 100 in number) worked very successfully.

The concentrated syrup was then grained in a small vacuum strike pan, emptied into a mixer and purged in a small centrifugal. The Yaryan distilling apparatus was erected by and at the expense of the Yaryan Manufacturing Co., Toledo, Ohio. Mr. Day, the courteous agent of this company, sent to erect and instruct in the use of the machine, spent several weeks at the Station and rendered valuable assistance in the sugar house.

The mixer and the settling tanks were generously donated by Messrs. Edwards & Haubtman, of New Orleans. The Whit-

ney Iron Works contributed the shafting and pulleys required to run the mixer and the centrifugal.

The conversion of an open kettle sugar house into the one just described was both expensive and tedious, demanding more than an ordinary knowledge of machinery and the requisites of a sugar house. Fortunately the Station had a volunteer assistant, whose rare mechanical genius, love of machinery, experience in a sugar house, and persistent industry was fully equal to the occasion, and the subsequent working of the sugar house gave indisputable evidence of his fitness to adapt pieces of machinery, gathered from many quarters, to each other and all to the sugar house and the requirements of the Station. To Mr. Jno. P. Baldwin, Jr., Baldwin, La., this Station is indebted not only for the above mentioned work, but for other valuable assistance in the field and sugar house.

The sugar house was completed and work begun in it, on October 21st, 1886.

ELEMENTARY CHEMISTRY OF THE SUGAR CANE.

Before proceeding with a description of the experiments in the sugar house, a short presentation of the chemistry of the sugar cane may not be inappropriate.

The composition of the sugar cane varies. 1st, with varieties. 2d, with soils upon which they are grown. 3d, with different manures. 4th, with different climates and seasons. 5th, with different degrees of maturity. 6th, with different parts of the stalk of the same cane, and 7th, with plant, and rattoons of different years.

1st. It is well known to every planter that different varieties give very different amounts of sugar. The analyses of 13 different kinds of cane grown upon "le champ d'experiences" of the Agronomic Station of Reunion and harvested at the end of 20 months, show that cane sugar varied between 13 and 21 per cent and glucose between .07 and 1.48. Our own analyses of 16 kinds grown last year on this Station (see Bulletin No. 7, page 10) show similar results.

2d. The soils upon which cane is grown have decided effects upon the content of sugar. To a Louisiana planter, it is well

known, that the black lands produce sweeter cane than sandy.

3d. Different manures effect materially the growth and maturity of canes and therefore their sugar content. Large quantities of Nitrogenous manures are always detrimental to large sugar yields.

4th. Different climates and in the same climate, different seasons, produce canes varying greatly in sugar content. In dry localities, and in dry seasons, canes are small, with much fibre and sugar. In damp climates aad in wet seasons, the canes are gorged with humidity, low in sugar and rich in glucose.

5th. At different degrees of maturity the cane varies greatly in analyses.

The results determined at the Agronomic Station of Reunion upon the same variety of cane show this conclusively.

ANALYSES OF CANE AT DIFFERENT AGES.

Age.	Sucrose.	Glucose.
10 months.	11.21 per cent	3.01 per cent
13 "	12.44 " "	2.55 " "
15 "	15.15 " "	1.05 " "
16 "	16.25 " "	0.36 " "
18 "	20.65 " "	0.22 " "
20 "	21.03 " "	0.07 " "

It is well known in Louisiana that cane ground in December is richer ln sugar than that ground in October.

6th. Sugar and the other elements in cane are very differently represented in the different parts of the same stalk. The middle and lower parts are the richest in sugar. The following analyses show this:

ANALYSES OF DIFFERENT PARTS OF THE CANE.

	White upper end.	Upper red part.	Middle.	Lower.
Sucrose............	3.80	13.57	18.09	18.59
Gluose............	1.33	0.81	0.16	0.14
Water............	84.05	76.89	70.42	68.92
Fibre	9.96	9.51	10.71	11.55
Organic Matter....	0.38	0.35	.32	0.30
Salts	0.48	0.47	.30	0.50
	100.00	100.00	100.00	100.00
Degree Baume	3.70	9.30	11.60	2.00

This is convincing proof of the expediency in cutting cane for the mill, to "lower the knife" so as to avoid the upper immature joints, which cannot increase, but may seriously decrease the sugar yield. To the above may be added the fact that the bark or rind of the cane, the nodes and the central pith, do not contain the same amount of sugar, hence the juice from the first mill, coming mainly from the pulp of the cane is richer in sugar than that from ihe second mill, which is presumed to come by increased pressure from the outer rind.*

7th. Plant cane varies from stubble cane in its content of fibre and sugar, as is well known to all sugar planters.

With these announcements, it is not surprising to find so great a discrepancy in the many analyses of sugar cane given to the public by distinguished chemists. Again few realize how difficult it is to make a complete analysis of cane, especially of the numerous elements present in very small qnantities, both on account of the absence of exact methods of analyses and of the rapid transformation which takes place as soon as the juices of the cane are removed from the influences of vitality.

ANALYSES OF CANE.

The following is the classical analysis of Payen, made upon stalks of Otaheite cane sent from Martinique and chosen specially for the researches, which they eubsequently received. It is to be observed that this distinguished chemist with others, found

*Maumene Fabrication de Sucre Vol II page, 64.
*Bulletin No. 5, U. S. Department of Agriculture, page 48.

no uncrystallizable sugar present. But these are exceptions. All canes worked in the mill probably contain more or less of this substance. In Louisiana the percentage of glucose is between .5 and 2 per cent.

Water	71.04
Sucrose	18.02
Cellulose	9.56
Albumen and other Nitrogenous matter	.55
Resinous, Fatty and Coloring matter	.35
Mineral Salts (ash)	.48
	100.00

Many other standard analyses might be given, but the following will probably cover all that has been made and will give an idea as to the general composition of all canes.

The cane contains—

Water	from	73.38	to	69.54
Sucrose	"	10.00	to	20.00
Glucose	"	8.00	to	.00
Starch	"	.....	to	.....
Cellulose and Lignose		7.03	to	9.50
Gum		....	to	.....
Cerosin		....	to	.....
Fatty and Aromatic matter		....	to	.....
Albuminoids		1.17	to	0.55
Coloring matter		....	to	.....
Free Acids				
Silica				
Organic Salts { Malates, Oxalates, Acctates, Citrates, &c. } of Potash, Soda, Lime, Magnesia, Alumina, Iron				
Mineral Salts { Sulphates, Phosphates, Chlorides, Silicates }		0.42	to	0.35
		100.00	to	100.00

This table is not complete and yet it represents what is known of the composition of sugar cane.

The juice obtained by pressure usually contains nearly all the substances found in the cane, showing that the sucrose found in the cells of the cane is accompanied by a large number

of soluble substances, of a more or less variable nature, some useful, some indifferent, and others positively noxious to the product we wish to extract, by conversion into glucose, or by preventing its crystalization.

In the sugar house these foreign bodies are far from being without influence upon our operations, and if we wish to succeed under all circumstances, we should study the action of each in detail, as well as the influence of air, water, light and heat, upon our juices and syrups. A short examinatien of each may be beneficial.

HYDROCARBONS.

Starch, has not been found in the canes of Louisiana though reported in very small quantities in unripe canes of other countries. The chemical property of being transformed by acids at all temperature into dextrine, and then into glucose, makes it an undesirable element of cane juice. Lime combines with it and partially precipitates it. Tannin completely precipitates it. It is insoluble in alcohol and cold water, and is not to be feared in the sugar houses of this State.

Dextrine, produced easily from starch, is soluble in water and in dilute alcohol. Is not precipitated by any of the reagents used in the sugar-house. It can be removed by an ammoniacal solution of acetate of lead. In the presence of albuminoids, ferments, fatty matter, etc., this substance causes a marked decomposition of the sugar, producing fermentation of the lactic butyric and viscous order.

Besides being the cause of this active fermentation, which is prevented by a careful removal of the other foreign substances, it is a source of constant annoyance to the sugar boiler. It is not crystalizable, and is not precipitated by lime, therefore we find it accompanying the sugar to the strike pan, augmenting the masse cuite and restraining a portion of the sugar from crystalization. The Station has not found dextrine in freshly cut cane. In cane fermented either from exposure or in the windrow it was invariably found; in the latter case only in small quantities. Dextrine, like sucrose, turns the polarized ray of light to the right.

Gum is analogous in its action to dextrine. It is insoluble

in alcohol. It forms a soluble combination with lime, and like dextrine, it increases the molasses both by its weight and by the prevention of sugar from crystalization. The proportion of gummy matter in cane juice is very small, a fortunate circumstance since there is no known way of removing it. A solution of gum turns the polarized ray of light to the left.

Glucose—This name, retained throughout this bulletin, is improperly given to the uncrystalizable sugar found in cane juice, though the latter is known to be a mixture of Dextrose and Levulose. It is found in the largest proportions in unripe cane. It is probably formed by the dehydration of starch or cellulose, and in graminiferous plants is reconverted in the grain into starch. In the sugar plants it is converted into sucrose, how, the following theories have been offered in explanation: 1st. By simple dehydration. Glucose, $C^{12} H^{24} O^{12}$ minus water. $H^2 O$ =Sucrose, $C^{12} H^{22} O^{11}$. This theory is somewhat sustained by the fact that the leaves and tender parts of the cane contain the larger proportions of glucose, and that the researches of Ville and Deherain show it to be quite plausible. 2nd. The carbonic acid of the air is absorbed by the leaves of the cane, and is reduced under the influence of sunlight, the oxygen set free, while the carbon enters into combination with hydrogen and oxygen of the water present, forming oxalic, acetic, citric, tartaric, etc., acids which disappear to make room for sucrose and other neutral substances.

An examination of a young stalk of cane shows always the presence of both sucrose and glucose. As the stalk grows and approaches maturity the sucrose increases and the glucose decreases even to the point sometimes of disappearing completely. If now, the cane is not cut at maturity, it at once enters again in activity, and presents the opposite phenomenon of converting sucrose into glucose. Thus one may speak definitely of the causes producing glucose in the cane, viz.: A too active vegetation, the absence of sunlight, an abundance of rain, and a soil too rich, or too wet. The formation of sucrose, on the contrary, is "en rapport" with maturity of plant, dryness of soil, and air, and a great excess of solar light.

Again the slightest disturbance of the plant or its juice,

either through fermentation from a wound, from heat, from action of acids, from immaturity, and a thousand other ways, causes the sucrose to be converted into glucose. There is no practical way of eliminating it, and it passes into the molasses, restraining therein from crystalization, a quantity of sugar. This substance is the chief ingredient of molasses, and together with gum, dextrine, etc., oppose themselves by their viscosity to the separation of the crystals of sugar. The quantity of sugar thus restrained but not transformed, is variously estimated from one-half to twice the weight of the total gummy matters. Again a solution of pure sugar, or a solution of the mixture of glucose and sucrose can be concentrated without much coloration. But if glucose alone, or with sucrose, be heated with free or carbonated alkalies, the solution quickly assumes a brownish tint which deepens as the work progresses. This coloration is due to the formation from the glucose of melassic acid, and increases in proportion to the quantity formed. This coloration may be removed by bone black, but unless the alkalies be neutralized, which are the direct cause of this phenomenon, it will be reproduced after each decoloration, as soon as the work of concentration is renewed. Glucose is therefore the "bete noir" of the sugar maker. It is formed at the expense of sucrose, it engages in the masse cuite, unaltered sucrose, and it is the most powerful cause of the coloration of the sugar products. In the present condition of sugar manufacture no way is known of eliminating the glucose already and always existing in the juice in Louisiana canes, and therefore the most judicious care should be exercised to preserve the sucrose present, and to avoid the causes which convert it into glucose. We are obliged to submit gracefully to the disastrous consequences of that is already in the juice.

The pectose group—The process of pressure without heat as now practised in all of our mills, is believed to give us a juice free from pectic principles, especially when proper wire screens are interposed between the mill and the juice box to remove the fragments of the bagasse, broken off by the rollers. The heat of boiling water is required to convert pectose into a soluble form, pectine, and if the fragments of bagasse are carefully removed

before boiling, the juice should be entirely devoid of it. None has been found in any of the juices examined at this Station. Both tannin and lime however, remove all the pectose group likely to be found in juices by converting them into insoluble combinations.

Wax and resinous matters—The "*cerosin*" first named and examined by Mr. Avequin, of New Orleans, the whitish wax found adherent to the bark of the cane and to the part sheathed by the leaves, is insoluble in water, and therefore is without action in the juice. The violet or purple canes contain the greatest amount, striped next, and the white canes very little. On the violet it is said to be found to the extent of 75 to 100 pounds per acre. Dumas gives it the following composition: $C^{48}\ H^{50}\ O^{2}$, while Lewy, later, makes it $C^{46}\ H^{46}\ O^{2}$.

Fatty matters and essential oils—The former exert their influence most only when degeneracy of any kind occurs in the juice, as then it determines the formation of lactic butyric, mannitic or viscous products, forms of fermentation more destructive and objectionable than the regular and normal alcoholic kind. All fatty matters consist of fatty acids combined with glycerine. When lime is added it combines with the fatty acids and releases the glycerine which accompanies the sugar in the masse cuite, remains in the molasses and restrains from crystalization a certain proportion of sugar. It is customary with some sugar boilers to stop excessive foaming in the pan by the introduction of fat of some kind. This reprehensibie custom might with propriety and with better results be supplanted by the use of fatty acids alone, deprived of glycerine.

The essential oil, which gives that delicate perfume to the open kettle sugar house, and the agreeable odor of "mel de canne" to brown sugar should rather be conserved than destroyed. Most of it however is eliminated by the different treatments to which the juice is subjected in concentration. Glycerine alone of these bodies, is objectionabe, because of its increasing the quantity of molasses, both by its presence and its restraining power over sugar.

Albuminoids or nitrogenous bodies, such as albumen, legumine, fibrine and casein, are found in the cane. The latter

when grown on a soil, strongly manured with highly nitrogenous fertilizers, contain largely increased quantities of albuminoids. All planters are in accord on this point. Albumen and its congeners are the essential support of the ferment, which produces alteration of the sucrose. The ferment alone destroys a certain proportion of sucrose and dies, but in the presence of albuminoids, a rapid multiplication of new and active globules takes place, which replace the effete ones, and which destroy in a short time large quantities of sugar. The planter has no more redoubtable enemy than these albuminoids, which, if not removed, show themselves in every phase of concentration. Therefore to avoid their noxious influence, cane should be worked as soon as possible after being cut and the albuminoids removed from the juice as soon as practicable after coming from the mill. But their removal presents some difficulty. Some of them are soluble but coagulate by heat. Others soluble and not coagulable. Others insoluble but soluble by heat, and transformable after awhile by the prolonged action of water and heat into gelatine. This action is hastened by the presence of free acids. Lime precipitates only a portion of the albuminoids, and when used in excess causes a re-solution of a part already precipitated. Therefore in the ordinary treatment, we find these albuminoids accompanying the juices from the mill to the masse cuite, giving rise to the foaming which occurs in the concentration, augmenting the proportion of molasses, and engaging a part of the sugar by preventing its free crystalization. The employment of tannin, which unites with all or nearly all of them to form insoluble compounds, provided free lactic acid does not exist in the juice, followed by the usual treatment with lime, is said to be an excellent way of relieving the juices of these, the most powerful obstacles to tne obtaining of large *rendments*.

Along with the albuminoids occur a living globular ferment ready to perform the work of destruction, of breaking up complex compounds into simpler ones, or even into elements, as soon as the plant is removed from the influence of vitality. This ferment is precipitable by lime and tannin, destroyed by acids and alkalies and its activity suspended by heat.

Vegetable acids, with the exception of tannic, acetic and carbonic, have the property of changing sucrose into glucose. Acetic acid, while exercising no direct action on the sugar, often by its presence favors ropy or viscous fermentation. Therefore one can only hope to obtain a good treatment of sugar juice by perfect neutralization of all acids. If the juice be left acid sugar will be inverted, albuminoids will be dissolved, etc. If alkaline, a part of the sugar will go in the molasses as sucrate of lime, The presence then of free acid in the clarified juice should not be tolerated.

Vegetable bases may be considered in the sugar industry of Louisiana as of little or no importance.

Mineral matter—The influence of mineral matter upon the crystalization of sugar has been a subject of more controversy than any other connected with the sugar industry.

Alkalies, potash, and soda, and their carbonates—Doctors have disagreed in the past as to the effect of these substances upon sugar juices. It is now however pretty conclusively determined that they blacken the juices, by converting glucose into melassic acid and prevent an amount of sugar, according to best authorities, of about six times their own weight, from crystalization. They should therefore be neutralized with some inoffensive acid.

In a well defacated juice, potash and soda should be the only basic mineral elements of the cane present, since lime should precipitate the rest together with most of the acids, and any excess of lime used is precipitated by the proper reagent.

Mineral acids—Most of these are removed by the lime, forming insoluble combinations, and giving no very serious results to the sugar maker. The chlorides, particularly of potassium and sodium, not removed by lime, are objectionable. They do not destroy the sugar but they form double salts with it, and thus restrain in the molasses a goodly quantity of sucrose, the former preventing 4,582 and the latter 5,852 times their weight from crystalization. According to best authorities, coloring matters are generally removed in great part by the usual methods of defecation. They are entirely suspended by the use of sulphur-

SUMMARY OF ABOVE.

The aim of every manufacturer of sugar is to extract the largest possible quantity of sucrose, and leave the smallest possible uncrystalizable residue. Therefore the question arises how can this double condition be methodically accomplished. We know that gum, dextrine and glucose, prevent the free crystalization of sugar. We have seen that the pectic principles, nitrogenized bodies and certain salts, accomplished the same end. It is evident that free acids, with three exceptions, convert sucrose into glucose, causing a double loss, that of the transformed sugar, and that restrained in the molasses by this sugar. The formation of glucose, is believed to be the great cause of loss in Louisiana. The unavoidable causes of inversion are numerous. The natural acids of the cane, certain bases, the ferment, action of air, of water, and of heat, together, can alter so much sugar as to seriously decrease the yields. Add to that the free and indiscriminate use of sulphur, and the usual custom of leaving the juices quite acid, even after clarification, and the surprise is that so much sugar is made.

Work of the sugar house may be divided into

1st. Extraction of the juice.

2d. Purification of the juice usually termed clarification or defecation.

3d. Concentration.

4th. Cooking to grain.

5th. Purging the crystals.

Since all of this work is of a mechanical nature except the purification of the juice, this alone will be noticed here.

How long will a juice untreated remain without alteration, is a question often asked. It is best to answer by repeating that as soon as removed from the stalk, fermentation begins; the rapidity and violence depending upon temperature, condition of weather, etc. The natural ferment present is very active, and is aided more or less by the natural acidity of the juice, and the temperature of the sugar house. It is important then never to delay the purification of the juice. The fundamental principle involved in the clarification of juice, is either to remove or render inoffensive, all the foreign matters in the juice, and is prac-

tically performed in two ways by the addition of reagents 1st. Which will produce insoluble compounds which are removed. 2nd. Which will neutralize all causes of alteration to the sucrose. These are chemical means, and are aided by mechanical and physical processes equally as essential.

The reagents used in Louisiana are sulphur, bi-sulphite of lime, lime, superphosphate of lime, superphosphate of alumina, tannin and bone black.

SULPHUR.

Sulphur is burnt and converted into sulphur dioxide, one part uniting with two parts of the oxygen of the air to form a gas which has an irritating odor, but with bleaching and antiseptic powers. Pure water dissolves under ordinary pressure 43.5 times its own volume of this gas. Cane juice under the same conditions absorbs 33. *A solution of this gas, exposed to the air absorbs oxygen, and is gradually converted into sulphuric acid.*

In Louisiana this gas is forced by machinery into the cane juice as it comes from the mill. Laboratory experiments indicate that 1 ounce of sulphur suffices for the perfect clarification of 300 gallons of juice. Yet in daily practice this is greatly exceeded. Sulphured juices should be handled with great care and skill, since this gas is an acid, which in itself has the power of inverting sucrose, and further, is easily converted into sulphuric acid, a most energetic destroyer of sugar. Sulphured juices should therefore be worked as early as possible, and *never heated* before *being limed.* It is a good practice to run a small quantity of lime water into the juice at the mill before sulphuring, to unite with and render insoluble, any sulphuric acid formed in the combustion of sulphur, and which has escaped the wash water. Sulphur acts upon the juice in three ways:

1st. It temporarily arrests fermentation.

2nd. It temporarily decolorizes.

3d. It assists in rendering coagulable a portion of the albuminoids.

Against these good offices are to be placed the constant danger of inverting sugar, the decreased yields, the difficulty of cooking its syrups without filtration, the difficulty of preserving sugar made by its use, and the formation of sulphates and sul-

phites in the juice, which interfere with the crystalization of sugar, and the deposition of scale upon the apparatus in which the juices are cooked, due to the formation of double sulphates. The last objection is especially troublesome, where neutral juices are worked. Sulphur has been used in sugar manufacture, from the raw juices to the masse cuite in the pan, and in all forms from the pure gas and its solution in water, to every one of its salts.

BISULPHITE OF LIME

What has been said of sulphur applies to this chemical, since it is the sulphurous acid present, which gives it its value.

LIME.

Lime is of universal use both in the manufacturies for beet and cane sugar. Nothing can be fonnd to supplant it. Lime performs the following work in defecation:

1st. It partially removes the albuminoids, and along with them the ferment.

2nd. It neutralizes all acids and forms with most of them insoluble compounds.

3d. It precipitates most of the vegetable bases.

4th. It precipitates most of the mineral bases except potash and soda, and these it leaves in a caustic state, a condition which should be corrected in subsequent operations on the juice.

5th. In the blanket and precipitate formed by the addition of the lime, a considerable quantity of the coloring matter, together with matters mechanically suspended in the juice, are restrained and removed.

In defecating with lime, care should be taken to see that neither too much nor too little is used. Either is destructive of good results. The juices should, after clarification, be neutral. This point is determined in factory practice in two ways. 1st. By test papers, blue and red. 2nd. By the eye, examining a sample either in a test tube or small glass jar, by the aid of transmitted light. If a good defecation has been made, there will be a rapid separation of the treated juice into a clear supernatant liquid with a light yellow color, and a thick, heavy

and persistent deposit. By a little practice the eye soon learns nearly the exact point of neutrality. Again each clarifier should be tested, since in this country it is almost impossible to find two successive clarifiers of juice of the same degree of maturity and acidity. It is a custom in some parts of the State to make lime paste, and to use so many cubic inches of this to each clarifier. This is a very uncertain quantity of pure lime. Unless the lime and water each be weighed and provision made to restore to the paste the water evaporated, very varying amounts of lime will be used in different clarifiers. It would be better to make a strong milk of lime in a barrel or tank, and determine the lime present by a Baume spindle, each degree representing about 1.6 ounces pure slaked lime per gallon, thus:

1	gallon	milk	of	lime	at	1° B	equals	1.6	ounces
1	"	"	"	"	"	2° B	"	3.2	"
1	"	"	"	"	"	3° B	"	4.8	"
1	"	"	"	"	"	4° B	"	6.4	"
1	"	"	"	"	"	5° B	"	8.0	"
1	"	"	"	"	"	6° B	"	9.6	"
1	"	"	"	"	"	7° B	"	11.2	"
1	"	"	"	"	"	8° B	"	12.8	"
1	"	"	"	"	"	9° B	"	14.4	"
1	"	"	"	"	"	10° B	"	16.0	" or 1 lb.

In this way exact amounts of lime to each clarifier can be calculated.

Lime unites with sucrose and glucose to form sucrates and glucates, the latter blackening the juice. Again in excess, it removes the acids from the potash and soda, and leaves them in a caustic state. These should be neutralized with some acid (best phosphoric), before the defecated juices are concentrated; if not they will convert the glucose present into melassic acid, which will blacken the syrup as the concentration proceeds, just in proportion to the amount of these ingredients present and the duration of heating.

SUPERPHOSPHATE OF LIME.

Is formed by treating any insoluble phosphate with sulphuric acid. In sugar use, the purest bone ash should be preferred and this should be treated with diluted sulphuric acid in quantities not sufficient to dissolve all of the ash. In this way free sulphuric acid will be nearly avoided in the compound. After

the lapse of a sufficient time for the action of the acid, the dried mass (acid phosphate) is dissolved in water and carefully filtered, and concentrated if necessary. In this way free Sulphuric Acid may be avoided and sulphate of lime, which is very slightly soluble in water is present in such small quantities as to produce no harm.

Superphosphate of lime prepared in this way is a valuable reagent, if used after the juice has been well defecated by lime to neutrality. This substance is an acid phosphate of lime, containing one part of phosphoric acid to one part of lime, and is soluble in water, while the normal phosphate of lime contains one part of phosphoric acid to three parts of lime and is insoluble in water and sugar juices. If the juices have been made neutral or very slightly alkaline, a small addition of this liquid will seize on to the slight excess of lime, and precipitate it at once as normal phosphate of lime. The phosphoric acid of another portion will unite with the potash and soda, to form phosphates of these bases, which remain in solution and will be found in the molasses, while the carbonic or any other acid that may be in combination with these alkalies in neutral juices, will unite with the lime and form also insoluble compounds. These two precipitates soon settle and carry with them much of the coloring matter. By this treatment the alkalies are removed from their injurious action both over the glucose in producing melassic acid and of their restraining influence upon the sugar in the molasses. It has been clearly demonstrated that potash and soda are rendered almost innocuous by transforming them into phosphates, and that no other acid will accomplish such good results. However, this substance should be used with care, and an excess avoided, since its acid nature will render inversion highly probable, and will dissolve the precipitates formed. It should be added in just such quantities as to slightly redden blue litmus paper.

In the use of this substance, care should be further taken to see that it was devoid of free acids particularly sulphuric.

SUPERPHOSPHATE OF ALUMINA.

Made in a similar manner from phosphate of alumina by the use of sulphuric acid, is used to accomplish the same purposes

as superphosphate of lime. In the decomposition however, slightly different chemical changes take place, one of which is the voluminous precipitation of aluminic hydrate in a gelatinous state, which, uniting with all the coloring matter present to form insoluble lakes, more completely decolorizes the juice. This precipitate takes a long time to settle, and on the whole does not do as effectual work as superphosphate of lime.

Phosphate of ammonia accomplishes the same purposes in perhaps a better manner than either of above, but its high cost prohibits an extensive use.

TANNIN.

Or more properly speaking, tannic acid, is found in *nut galls*, excrescences on oak trees ; in the bark of the different kinds of oak, chestnut, etc. The union of this substance with the gelatine of the hide forms leather. It has long been used by chemists to form insoluble compounds with the albuminoids, and to detect the presence of the latter even in very dilute solutions. Tannin precipitates all or nearly all of the albuminoids of the juice together with the ferment, and juices thus treated were kept in a warm labaratory for five or six days at this Station without a sign of alteration. It precipitates also starch, pectine, vegetable bases, most of the fatty and coloring matters. Juices first treated with tannin, then with lime and superphosphate of lime, were found to be better defecated, and cooked better and gave larger returns than any other experiments made in the Station's sugar house. An excess of tannin has no injurious effects on the crystalization of sugar and imparts no astringent properties to either sugar or molasses, so far as our taste and that of many others could determine. Lime however, removes any excess , and therefore any astringency that might adhere to its products, could easily be removed. Again the use of tannin decreases the amount of lime necessary in subsequent defecation. Its only objection, found in many trials in the sugar house, closely followed by analyses in the labaratory, and careful scrutiny of all working details, was the large quantity of settlings and the time required for them to precipitate, an objection which we think a filter press will entirely overcome.

The albuminoids precipitated by tannin are redissolved by lactic acid, which, however, is never found in fresh juices, it being a product of fermentation.

BONE BLACK.

Is the result of the calcination of bones without a free access of air. For filtration purposes, the more or less large grains are used. The properties of bone black have been known for a half century. Its decolorizing property and its power to remove a portion of the solid matter from the juices are utilized in sugar refineries. This substance is rarely used in Louisiana, its high price preventing, we suppose. The Station has made no use of this agent save in the laboratory. The action of this substance is physical rather than chemical.

Many other substances have from time to time been proposed for the purification of the juice, but they have not been adopted.

ACID SULPHITE OF ALUMINA.

Is one of the new reageants for the purification of juices proposed by Slibowitz, and is intended to supplant bone black in the refineries. It has been extensively applied in many factories in Austria, and it is said with success. It is used on diffused juices with the process of carbonatation. The juices are subjected to four saturations, the first two with the usual calcocarbonic treatment, and the last two with the addition of acid sulphite of alumina. The advantages are not in the precipitation of the non sugar, or in elevating the purity coefficient, but in its decolorizing power.

The juice is at all times kept faintly alkaline and the sulphurous acid can therefore do no inversion. This compound is decomposed in the juice and the sulphurous acid and the aluminic hydrate in their nascent states, exercised increased decoloring power. The absence of sulphates and sulphites of lime in the products, the suppression of bone black and the attainment of products of normal composition are the principal claims in Austria. In the National Experiments on diffusion of cane soon to be made at Magnolia, this process will doubtless be tried and its merits tested.

The station was unable to obtain this chemical in the New

York market last fall, and therefore could not make an experiment with it in the sugar house. Several ounces were however made in the laboratory and these were used in an experiment with several litres of juice which was highly satisfactory from point of sight alone. The sugar grained well and was of a very bright color. In this experiment only lime and acid sulphite of alumina were used, and our process was very different from that practised in Austria.

SUGAR HOUSE RESULTS.

Experiments were begun in sugar house, October 29th, beginning with Plat No. 2, Field Experiments, results of which have been given in Bulletin No. 7.

Our first experiments were made for the purpose of giving us a "datum line" to which we could refer the rest. Accordingly with the exception of No. 1, only lime was used in defacating until we reached No. 23, then lime and commercial superphosphate of lime, were used up to 30; then sulphur and lime through balance of Plat 2, and a part of Plat 7. The remainder of the experiments were with tannin.

As the work progressed we made more extensive laboratory analyses, determining glucose and ash, besides total solids and sucrose. We also made frequent weighings with analyses of the juices in different stages of concentration and masse cuites, all of which are given in appropriate places.

PLAT No. 2.

Size of each Experiment one-twentieth of an acre.

EXPERIMENT NO. 1.

Manures used—10 lbs. Cotton Seed Meal and 5 lbs. Acid Phosphate.
Weight of Cane—1,630 lbs., Yield per acre, 16.30 tons.
Weight of Bagasse—532 lbs., Weight of juice, 1098 lbs.
Extraction—67.36, Bagasse, 32.64.

TREATMENT OF JUICE.

Very slightly sulphured; limed to nearly neutrality; four *grammes to gallon of juice; concentrated in open pan; grained in vacuum; centrifugalled; only first sugars were made except in a few instances and they are given under a special head.

*One gramme equals about 15 grains or 28 grammes equal about 1 oz.

LABORATORY ANALYSES.

Kind of Product.	Degrees Baume.	Total Solids.	Sucrose.	Glucose.	Coeficient of Purity.
Raw juice	7.6°	13.7	10.9	2.04	79.5
Limed juice	8.25°	14.9	12.3	2.19	82.6
Concentr'd juice	24.15°	44.2	35.0	......	79.2
First sugar	......	......	90.2	......	....
Molasses	......	......	43.8	......	....
Skimmings	......	......	12.5	......	....

SUGAR HOUSE RESULTS.

70 lbs. first sugars, polarizing 90.2 per cent sucrose = 63.14 lbs pure sugar
90 lbs. molasses, polarizing 43.8 per cent sucrose = 39.42 lbs pure sugar
117 lbs skimmings and settlings polariz'g 12.5 p c sucrose=14.62 lbs pure sugar

Total sugar acconnted for..............................117.18 lbs pure sugar
Total sugar in 1098 lbs juice polarizing ...... 10.97=119.68 lbs pure sugar

Amount lost by inversion, waste, etc., difference.. 2.50 lbs pure sugar

EXPERIMENT No. 2.

Manures used—16⅔ lbs. Cotton Seed Meal, and 8½ lbs. Acid Phosphate.
Weight of Cane—1752 lbs., Yield per acre, 17.52 tons.
Weight of Bagassse—576 lbs., Weight of juice, 1176 lbs.
Extraction—67.10, Bagasse 32.90.

EXPERIMENT NO. 5.

Manures used—30 lbs. Cotton Seed Meal and 15 lbs. Acid Phosphate.
Weight of Cane—2246 lbs., Yield per acre, 22.46 tons.
Weight of Bagasse—686 lbs., Weight of juice, 1560 lbs.
Extraction—69.50, Bagasse, 30.50.
Juices of Nos. 2 and 5 wero worked together.

TREATMENT OF JUICES.

No Sulphur used ; 4 grammes Lime to gallon of juice ; weather warm and juice slightly fermented.

LABORATORY ANALYSES.

Kind of Product.	Degree Baume.	Total Solids.	Sucrose.	Coefficient of Purity.
Raw juice No. 2	7.2	12.9	10.6	81.3
Raw juice No. 5	7.2	13.0	11.0	84.0
Limed juice No. 2	7.4	13.3	10.4	77.2
Limed juice No. 5	7.8	14.0	10.9	77.8
Concentrated juice No. 2	26.0	47.7	35.3	74.8
Concentrated juice No. 5	26.5	48.7	37.8	77.6
First sugar	——	——	89.5	——
Molasses	41.	77.3	43.0	55.6

SUGAR HOUSE RESULTS.

An accident occurred by which an unknown quantity of syrup ready for the pan was lost. Results obtained, 151 lbs sugar, and 116½ lbs molasses, were far too low. Without use of sulphur, on such a warm day, maximum temperature 70° acetous fermentation set in before the raw juice could be treated, hence inversion, which was arrested in concentration.

EXPERIMENT NO. 3.

Manures used—7 lbs. Sulphate Ammonia,
6 lbs. Dried Blood, 10 lbs. Cotton Seed Meal Put out May 24th.
20 lbs. Acid Phosphate,
Weight of Cane—2122 lbs., Yield per acre 21.22 tons.
Weight of Bagasse—616 lbs., Weight of juice, 1506 tons.
Extraction—70.9 per cent., Bagasse 29.1 per cent.

TREATMENT OF JUICES.

Limed to neutrality; warm weather, without sulphur, caused slight inversion before raw juice could be treated, checked by concentration.

LABORATORY ANALYSES.

Kind of Product.	Degrees Baume.	Total Solids.	Sucrose.	Glucose.	Coefficient of Purity.
Raw juice	7.	12.6	10.6	1.66	84.
Limed juice	7.5	13.4	10.9	1.73	81.
Concentrated juice	24.	43.9	35.8	6.13	81.
Sugar	—	—	91.5	—	—
Molasses	41.	77.3	45.0	—	58.

SUGAR HOUSE RESULTS.

108 lbs Sugars polarizing 91.5 per cent=97.74 lbs pure sugar.
97 lbs Molasses polarizing 45.05 per cent=43.69 lbs pure sugar.

Total sugar in sugar and molasses.........141.43 lbs. pure sugar.
Total sugar in 1506 lbs. juice @ ....10.61=159.64 lbs. pure sugar.

Skimmings, inversion and loss........... 18.21 lbs. pure sugar.

The skimmings and settlings from above were not weighed, and hence loss from inversion cannot be estimated.

EXPERIMENT NO. 6.

Manures used—30 lbs. Cotton seed, 15 lbs Acid phosphate, and 15 lbs. kainite.

Weight of cane—2229 lbs., Yield per acre 22.29 tons.
Weight of bagasse 656 lbs., Weight of juice 1573 lbs.
Extraction—70.6 per cent., Bagasse 29.4 per cent.

TREATMENT OF JUICES.

No sulphur; limed and left slightly acid, using 3.8 grammes of lime per gallon; fermentation set in before the juice could be concentrated.

LABORATORY ANALYSES.

Kind of Product.	Degree Baume.	Total Solids.	Sucrose.	Glucose.	Coefficient of Purity.
Raw juice..............................	7.2	12.9	10.4	1.70	80.6
Limed juice............................	7.4	13.3	11.0	1.72	82.7
Concentrated juice....................	25.	45.9	35.2	7.04	76.6
Molasses................................	40.	75.3	43.3	....	57.5
Sugar	——	....	96.0	....	

SUGAR HOUSE RESULTS.

107 lbs sugar polarizing 96. per cent=103 lbs pure sugar.
103 lbs molasses polarizing 43.3 per cent=44.6 lbs pure sugar

Total in sugar and molasses.......147.6 lbs pure sugar
1573 lbs juice polarizing 10.4 per cent=163.59 lbs pure sugar.

Loss in skimmings, inversion, etc.,.....15.99 lbs pure sugar.

Skimmings and settlings not weighed.

EXPERIMENT NO. 4.

Manures used—23 lbs. Cot. seed meal and 11½ lbs. Acid phosphate

This Experiment was divided into 3 equal parts. No. 1, not desuckered at all, but every facility afforded for suckering. No. 2, not a sucker was permitted to grow during the season. No. 3, the suckers were removed till June 22d, after which they were permitted to grow. See Bulletin No. 7, for detail.

No. 1 yielded at rate of 22.63 tons to acre polarizing 10.6.
No. 3 " " " " 19.32 " " " " 10.
No. 2 was worthless and not weighed or gathered. The above was converted into molasses.

EXPERIMENT NO. 7.

Manures used—30 lbs. Cotton seed meal.
Weight of cane—1864 lbs., Yield per acre, 18.64 tons.
Weight of bagasse—594 lbs., Weight of juice 1270 lbs.
Extraction—68.17, Bagasse 31.91.

TREATMENT OF JUICE.

Lime used (5.1 grammes to gallon) to neutrality—concentrated in open pan, cooked in vacuum and centrifugalled.

LABORATORY ANALYSES.

Kind of Product.	Degrees Baume	Total solids.	Sucrose.	Glucose.	Co-effit. Purity
Raw juice	6.9	12.4	9.6	1.89	77.
Limed juice	7.3	13.1	10.5	1.84	80.
Concentrated juice	16.6	29.7	23.2	4.76	78.
Molasses	33.	61.2	32.6	......	53.
Sugar	......	......	87.6	......	......
Skimmings	......	......	6.8	......	......

SUGAR HOUSE RESULTS.

95 lbs. Sugar polarizing................ 87.6=83.16 lbs. pure sugar.
31 lbs. Molasses " .... 32.6=26.56 " " "
85 lbs. Skimmings " .... 6.8 5.77 " " "

Total sugar accounted for.................. 115.49 " " "
Total in 1270 lbs. juice polarizing 9.6 pr. ct.=121.92 " " "

Loss by inversion and otherwise 6.43 " " "

Here the skimmings and settlings were worked three times with great care and yet they finally contained 5.77 lbs. sugar, which was thrown away and were doubtless the cause of a part of the inversion found above. This amount 5.77 lbs. is nearly 5 per cent on the total sugar worked.

EXPERIMENT NO. 8.

Manures used—13 lbs Sulphate ammonia, 23 lbs Acid phosphate, and 4 lbs. Muriate potash, put out May 24th, 1887.
Weight of cane—1902 lbs; Yield per acre, 19.02 tons.
Weight of bagasse—628 lbs., Weight of juice, 1278 lbs.
Extraction—66.9 per cent., Bagasse 33.1 per cent.

TREATMENT OF JUICE.

Lime used, 3.5 grammes to gallon, and left slightly acid. Fermentation slightly occurred before the raw juice could be cooked.

LABORATORY ANALYSES.

Kind of Product.	Degrees Baume	Total Solids.	Sucrose.	Glucose.	Co-effi't Purity
Raw juice	7.5	13.6 p c	10.8 p c	1.46	79
Limed juice	7.9	14.2 p c	10.9 p c	1.58	77
Concentrated juice	25.	45.8 p c	34.70	5.55	76
Molasses	...	.... p c	....	....	..
Sugar	...	.... p c	....	....	..
Skimmings	...	.... p c	....	....	..

SUGAR HOUSE RESULTS.

An amount of juice estimated to be about 10 gallons, was accidentally lost which vitiated the accuracy of results. Hence sugar and molasses not analysed. There were obtained however, 80 lbs sugar, 117 lbs molasses, and 65½ lbs skimmings out of a possible sugar content of 137½ lbs.

EXPERIMENT NO. 9.

Manures used—15 lbs. Acid phosphate and 15 lbs. Kainite.
Weight of cane—1500 lbs., Yield per acre 15 tons.
Weight of bagasse—504 lbs, Weight of juice 996 lbs.
Extraction—66.4 per cent., Bagasse 33.6 per cent.

TREATMENT OF JUICE.

Limed to neutrality—using 4.1 grammes per gallon. However a very slight fermentation occurred before the last raw juice could be concentrated.

LABORATORY ANALYSES.

Kinds of Product.	Degrees Baume	Total Solids.	Sucrose.	Glucose.	Co-effit. Purity
Raw juice	7.2	12.9	10.1	1.83	78.
Limed juice	7.5	13.5	11.	1.85	81.
Concentrated juice	16.	29.	22.1	4.11	76.
Molasses	37.	69.2	38.4	......	55.
Sugar	......	......	89.2	......	......
Skimmings	79.	14.2	10 8	......	76.

SUGAR HOUSH RESULTS.

61 lbs. Sugar polarizing........................89.2=	54.42	lbs. pure sugar.
95 lbs. Molasses polarizing......................38.4=	36 28	" " "
86 lbs. Skimmings, polarizing..................10.8=	9.29	" " "
Total sugar accounted for........................	100.99	" " "
Total Sugar in 996 lbs. juice polarizing........10.1=	100.59	" " "
Gain....................................	.40	

EXPERIMENT NO. 10.

Manures used— 15 lbs Kainite.
Weight of cane—1492 lbs. Yield per acre 14.92 tons.
Weight of bagasse—494 lbs., Weight of juice 998 lbs.
Extraction—66.9 per cent., Bagasse 33.1 per cent.

TREATMENT OF JUICE.

Limed to neutrality, using 4.1 grammes to gallon.

LABORATORY ANALYSES.

Kind of Product.	Degrees Baume.	Total Solids.	Sucrose.	Glucose.	Co-eff't Purity.
Raw juice............................	7.8	14.0 p c	10.7 p c	1.72 p c	76.
Limed juice............................	8.0	14.4 p c	11.5 p c	1.83 p c	80.
Concentrated juice....................	26.	47.7 p c	38.1 p c	7.40 p c	80.
Molasses	31.	57.3 p c	33.8 p c	....	...
Sugar................................	....	....	90.8 p c	....	...
Skimmings............................	....	....	10.8	....	...

SUGAR HOUSE RESULTS.

80 lbs. Sugar polarizing..............90.8 per cent= 72.64 lbs. pure sugar
64 lbs. Molasses polarizing...........33.8 per cent= 21.63 " " "
85 lbs. Skimmings polarizing.........10.8 per cent= 9.18 " " "

Total Sugar accounted for............. 101.45 " " "
Total sugar in 998 lbs. juice @........10.7 per cent=106.78 " " "

Loss.......................... 2.33 " " "

EXPERIMENT NO. 11.

Manures used—10 lbs. Cotton seed meal and 5 lbs. Floats.
Weight of cane 1254 lbs., Yield per acre 12.54 tons.
Weight of bagasse 418 lbs., Weight of juice 836 lbs.
Extraction 66⅔ per cent., Bagasse 33⅓ per cent.

TREATMENT OF JUICE.

Limed to neutrality—using 4 3 grams per gallon.

LABORATORY ANALYSES.

Kind of Product.	Degree Baume.	Total Solids.	Sucrose.	Glucose.	Co.effit. Purity.
Raw juice	8.0	14.4	11.8	1.58	81.9
Limed juice	8.6	15.5	12.9	1.61	82.5
Concentrated juice	24.0	43.9	35.2	4.71	80.1
Molasses	32.	59.3	39.2	......	66.1
Sugar	......	......	94.2	....	......
Skimmings	9.6	16.2	6.6	......	40.74

SUGAR HOUSE RESULTS.

51 lbs. Sugar polarizing..........................94.2=48.04 lbs. pure sugar
61 lbs. Molasses polarizing.......................39.2=23.91 " " "
170 lbs. Skimmings polarizing .... 6.6=11.23 " " "

Total sugar accounted for..... .... 83.17 " " "
Total sugar in 836 lbs. juice polarizing..........11.8=98.64 " " "

Loss from inversion, &c................ ..... 15-47 " " "

The skimmings and settlings, an unusually large amount (170 lbs.) on account of condition of weather (warm, damp and sultry) fermented rapidly and prevented working as contemplated. The loss of cane sugar by it was very heavy. The skimmings should have had a co-efficient of purity nearly as great as the raw juice. With 16.2 per cent of total solids this would have given, with 80 purity co-efficient 12.9 per cent sugar or a total in the skimmings of 21 lbs. We find by analyses only 6.6 per cent sugar or a total of 11.22 lbs., showing 10.68 lbs. as having been inverted in the skimmings; subtracting this amount from the total loss above and we have 4.74 lbs., due probably to losses in the manipulation of the sugar.

This experiment clearly demonstrated the necessity of working up rapidly the juice as fast as it comes from the mill, especially if the weather is warm and sultry and no sulphur used. It also shows that the albuminoid matter in scums, under such favorable conditions rapidly invert the sugar present. Further on we will illustrate the advantages of a filter press in preventing such losses.

EXPERIMENT NO. 12.

Manures used—16¾ lbs. Cotton seed meal, and 8½ lbs. Floats.
Weight of cane—1574 lbs.; Yield per acre, 15.74 tos.
Weight of bagasse—490 lbs., Weight of juice 1084 lbs.

TREATMENT OF JUICE.

Limed to nearly neutrality, using 4.2 grammss per gallon. The juice was worked slightly acid.

LABORATORY ANALYSES.

Kind of Product.	Degrees Baume.	Total Solids.	Sucrose.	Glucose.	Acid in raw juice	Co-eff't Purity.
Raw juice	7.6	13.7	11.2	1.72	.018	81.7
Limed juice	8.2	14.8	11.9	1.76	....	80.4
Concentrated juice	25.	45.8	36.2	5.46	....	79.2
Molasses	38.	71.2	44.8	....	....	62.9
Sugar	....	....	90.1	....	....	....
Skimmings	....	....	12.9	....	....	....

SUGAR HOUSE RESULTS.

70 lbs. Sugar polarizing......................90.1 =	63.07	lbs.	pure	sugar.
70 lbs. Molasses polarizing....................44.85=	39.50	"	"	"
68 lbs. Skimmings polarizing.................12.90=	8.77	"	"	"
Total sugar accounted for....................	111.34	"	"	"
Total sugar in 1084 lbs juice...................11.2	121.40	"	"	"
Loss by insverion............................	10.06	"	"	"

The weather was quite warm and sultry, with a rainfall of one inch during the day, and therefore fermentation entered our juices in spite of efforts to prevent.

EXPERIMENT NO. 13.

Manures used—23 lbs. Cotton meal and 11½ lbs., Floats, applied May 24th.
Weight of cane—1734 lbs ; Yield per acre, 17.34 tons.
Weight of bagasse—560 lbs., Weight of juice 1174 lbs.
Extraction—67.7 per cent, Bagasse 32.3 per cent.

TREATMENT OF JUICE.

Limed in excess, using 6 grammes per gallon. The juice was therefore worked alkaline.

LABORATORY ANALYSES.

Kind of Product.	Degrees Baume.	Total Solids.	Sucrose.	Glucose.	Co-eff't Purity.
Raw juice	8.0	14.4	12.	1.18	83.
Limed juice	7.9	14.2	11.8	1.14	83.
Concentrated juice	18.0	32.7	26.5	....	81.
Molasses	30.0	55.4	37.1	14.8	66.9
Sugar	....	....	96.	....	...
Skimmings	....	....	9.3	....	....

SUGAR HOUSE RESULTS.

81 lbs. Sugar polarizing........................96. = 77.76 lbs. pure sugar.
127 lbs. Molasses polarizing...................37.1= 47.12 " " "
130 lbs. Skimmings polarizing.................. 9.3= 12.09 " " "

Total sugar accounted for...................... 136.97 " " "
Total sugar in 1174 lbs. juice polarizing.......12.4=145.67 " " "

Loss by inversion, alkalinity, etc.,......... 8.60 " " "

Here there was a gain in glucose in the molasses, due to fermentation induced by prevailing warm and sultry weather, of about three lbs. This with the glucose in the sugar, and scums, and the sucrate of lime removed or left in the molasses may account for some of the apparent loss —95 parts of cane sugar, making 100 parts of glucose or invert sugar.

EXPERIMENT NO. 14.

Manures used—23 lbs. Cotton meal and 11½ lbs. Floats put out October 19.
Weight of cane—1832 lbs., Yield per acre 18.32 tons.
Weight of bagasse—620 lbs., Weight of juice 1212 lbs.
Extraction—66.1 per cent, Bagasse 33.9 per cent.

TREATMENT OF JUICE.

Limed to neutrality, using 6.2 grammes to gallon.

Kind of Product.	Degree Baume.	Total Solids.	Sucrose.	Glucose.	Co-efficient of Purity.
Raw juice	7.6	13.9	11.1	1.55	81.02
Limed juice	8.2	14.8	12.5	4.63	84.40
Concentrated juice	21.0	38.3	31.0	......	81.00
Skimmings	......	......	11.9	......	......

SUGAR HOUSE RESULTS.

An accident prevented the successful working of this experiment and only 57½ lbs. sugar and 78 lbs. molasses were obtained.

EXPERIMENT NO. 15.

Manures used—30 lbs. Cotton meal and 15 lbs. Floats.
Weight of cane—2020 lbs., Yield per acre 20.20 tons.
Weight of bagasse—710 lbs., Weight of juice 1310 lbs.
Extraction—64.85 per cent, bagasse 35.15 per cent.

TREATMENT OF JUICE.

Limed to neutrality, using 4.4 grammes per gallon.

LABORATORY ANALYSES.

Kind of Product.	Degree Baume.	Total Solids.	Sucrose.	Glucose.	Co-efficient of Purity.
Raw juice	7.6	13.7	11.5	1.80	83.
Limed juice	7.6	13.7	11.8	1.60	86.
Concentrated juice	25.0	45.9	38.5	......	84.
Molasses	36.0	64.8	42.1	19.60	65.
Sugar	......	......	92.	1.15	......
Skimmings	7.4	13.4	10.5	2.12	79.

SUGAR HOUSE RESULTS.

94 lbs. Sugar polarizing	92=	86.48	lbs. pure sugar
92 lbs. Molasses polarizing	42.1=	38.73	" " "
164 lbs. Skimmings polarizing	10.5=	17.22	" " "
Total sugar accounted for		142.43	" " "
Total sugar in 1310 lbs. juice polarizing	11.5=	150.65	" " "
Loss in sugar		8.22	lbs.

Since the purity co-efficient, held up very well in concentrating this juice an effort was made to find out the cause of this loss. The following calculations show that it was not all inverted.

GLUCOSE COMPARISON.

1310 lbs. Juice had @	1.8 per cent=23 58 lbs. glucose		
94 lbs Sugar @	1.15=1.08 lbs.		
92 lbe. Molasses @	19.6=18.03 "		
164 lbs. Skimmings @	2.12=3.47 "		
Total recovered			22.58
Leaving of original glucose unrecovered.			1.00

A similar calculation will show a loss also in total solids therefore the conclusion was reached that there had been a loss of syrup somewhere in the cooking, perhaps in the overflow of the pan. Accordingly a strict watch was placed on the latter, and to our surprise, occasionally an overflow would occur, especially when the juices were acid or the pan very full, which seriously vitiated our results.

EXPERIMENT NO. 16.

Manures used—30 lbs. Cotton seed meal, 15 lbs. Floats, and 15 lbs. Kainite.
Weight of cane—1910 lbs, Yield per acre 19.10 tons.
Weight of bagasse—651 lbs., Weight of juice 1259 lbs.
Extraction—65.9 per cent., Bagasse 34.1 per cent.

TREATMENT OF JUICE.

Limed to perfect neutrality, using 3.9 grammes per gallon and concentrated in Yaryan's Vacuum Distilling Apparatus.

LABORATORY ANALYSES.

Kind of product.	Degrees Baume	Total Solids.	Sucrose.	Glucose.	Co-eff't Purity.	Glucose per centage Sucrose
Raw juice	8.5	15.4	11.6	1.32	75.3	11.4
Limed juice	8.9	16.2	13.4	1.48	82.7	11.0
Concentrated juice	20.0	36.5	30.0	3.88	82.1	12.9
Molasses	....	....	....	....	....	....
Sugar	....	....	95.0	....	....	....
Skimmings	6.4	11.6	8.7	.92	75.	....

SUGAR HOUSE RESULTS.

92 lbs. Sugar polarizing 95.
79.5 lbs Molasses, sample not analyzed (lost).
140 lbs. Skimmings polarizing 8.7.

The failure to have molasses analyzed prevented a calculation of results. The purity coefficients indicate a successful clarification and concentration. Here for the first time the vacuum distilling apparatus, (single effect), erected by Yaryan Manufacturing Company, of Toledo, Ohio, was used to concentrate the juice. This apparatus was subsequently used in over 100 experiments, and as far as we could judge from weights and analyses, neither inverted nor overflowed, points of great rec-

ommendation. It is very easily worked by any one having even a rudimentary knowledge of machinery.

EXPERIMENT NO. 17.

Manures used—30 lbs. Cotton seed meal, 15 lbs. Floats, 15 lbs. Kainite, and 10 lbs. Gypsum.
Weight of cane—1806 lbs., Yield per acre 18.06 tons.
Weight of bagasse—612 lbs., Weight of juice 1194 lbs.
Extraction—66.1 per cent., Bagasse 33.9 per cent.

TREATMENT OF JUICE.

Limed to perfect neutrality, using 3 grammes per gallon, and concentrated in the Yaryan.

LABORATORY ANALYSES.

KIND OF PRODUCT.	Degrees Baume.	Total Solids.	Sucrose.	Glucose.	Co-effi't Purity.
Raw juice	7.9	14.3	10.90	1.17	76.2
Limed juice	8.4	15.2	12.15	1.51	80.
Concentrated juice	23.2	42.5	33.90	4.59	79.7
Molasses	38.0	71.3	44.60	12.15	61.1
Sugar	....	....	95.00	1.08	....
Skimmings	7.7	13.9	9.00	1.13	64.7

SUGAR HOUSE RESULTS.

82 lbs. Sugar polarizing	95.	= 77.9	lbs. pure sugar.
85 lbs. Molasses polarizing	44.6	= 37.91	" " "
126 lbs. Skimmings polarizing	9.	= 11.34	" " "
Total sugar accounted for		127.15	" " "
Total sugar in 1194 lbs Juice @	10.9	= 130.14	" " "
Loss		2.99	" " "

GLUCOSE CALCULATION.

1194 lbs Juice @	1.17=		13.96 lbs. glucose
Recovered in			
82 lbs. Sugar @	1.08=	.88	
85 lbs. Molasses @	12.15=	10.33	
126 lbs. Skimmings @	1.13=	1.42	
Total			12.63 lbs. ——
Loss in glucose			1.33 lbs.

EXPERIMENT NO. 18.

Manures—None.
Weight of cane—1626 lbs., Yield per acre 16.26 tons.
Weight of bagasse 584 lbs., Weight of juice 1042 lbs.
Extraction 64 per cent, Bagasse 36 per cent.

TREATMENT OF JUICE.

Limed to neutrality, using 2.3 grammes per gallon and concentrated in the Yaryan.

LABORATORY ANALYSES.

Kind of Product.	Degree Baume.	Total Solids.	Sucrose.	Glucose.	Co-efficient Purity.	Glucose per cent Sucrose.
Raw juice	8.5	15.4	12.1	1.54	78.5	12.7
Limed juice	8.6	15.5	12.6	1.50	81.2	11.9
Concentrated juice	15.5	28.1	23.3	3.29	82.9	14.2
Molasses	39.	73.4	45.5	11.80	......	......
Sugar	......	......	93.9	......	......	......
Skimmings	4.9	8.9	6.1	1.01	68.5	......

SUGAR HOUSE RESULTS.

68 lbs. sugar.
68 lbs. molasses.

EXPERIMENT NO. 19.

Manures used—30 lbs. Cotton seed meal, 15 lbs. Floats, 15 lbs. Kainite and 10 lbs. Gypsum.
Weight of cane—1636 lbs., Yield per acre 16.36 tons.
Weight of bagasse—548 lbs., Weight of juice 1098 lbs.
Extraction—67.1 per cent, Bagasse 32.9 per cent.

TREATMENT OF JUICE.

Limed to nearly neutrality, using 3.8 grammes per gallon—concentrated in the Yaryan.

LABORATORY ANALYSES.

Kind of Product.	Degrees Baume.	Total Solids.	Sucrose.	Glucose.	Co-efficient of Purity	Glucose per cent Sucrose.
Raw juice	8.4	15.1	12.4	1.61	82.1	13.
Limed juice	9.0	16.25	13.8	1.42	84.9	10.3
Concentrated juice	15.7	28.40	23.7	3.34	83.4	14.1
Molasses	30.	67.30	43.7	10.21	64.9	......
Sugar	.....	......	94.8	1.15	......	......
Skimmings	6.7	12.00	9.7	1.13	80.8	......

SUGAR HOUSE RESULTS.

75 lbs. sugar.
82 lbs. molasses.

Calculations on Experiments 18 and 19, are not made because small quantities of syrup were known to have overflowed during boiling. They are both short of theoretical results by about 18 lbs. But the purety co-efficients, especially No. 18, indicate a successful clarification and concentration.

EXPERIMENT NO. 20.

Manures used—15 lbs. Tankage.
Weight of cane 1640 lbs., Yeld per acre 16.40 tons.
Weight of bagasse 512 bls., Weight of juice 1128 bls.
Extraction 68.1 per cent, Bagasse 31.9 per cent.

TREATMENT OF JUICE.

(See Experiments with Filter press.)

EXPERIMENT NO. 21.

Manures used—23 lbs. Tankage.
Weight of cane 1440 lbs., Yield per acre 14.40 tons.
Weight of bagasse 530 lbs., Weight of juice 910 lbs.
Extraction 63.2 per cent, Bagaese 36.8 per cent.

TREATMENT OF JUICE.

Limed to neutrality—using 5.1 grammes per gallon and concentrated in the Yaryan.

LABORATORY ANALYSES.

Kind of Product.	Degrees Baume.	Total Solids.	Sucrose.	Glucose.	Co-efficient of Purity.	Glucose per cent Sucrose.
Raw juice	8.7	15.7	13.5	1.52	85.9	11.2
Limid juice	10.2	18.5	15.2	1.48	82.1	9.7
Concentrated juice	23.0	42.0	35.2	......	83.8	......
Molasses	39.0	73.3	49.8	7.96	67.9	......
Sugar	......	......	94.5	.89	......	......
Skimmings	8.8	15.9	12.6	1.03	79.2	......

SUGAR HOUSE RESULTS.

78 lbs. Sugar polarizing	94.5=	73.71	lbs. pure sugar.
70 lbs. Molasses polarizing	49.8=	34.86	" " "
116 lbs. Skimmings polarizing	12.6=	13.61	" " "
Total sugar accounted for		122.18	" " "
Total sugar in 910 lbs. juice @	12.5=	122.85	" " "
Loss		.67	" " "

EXPERIMENT NO. 22.

Manures used—35 lbs. Tankage.
Weight of cane—1660 lbs., Yield per acre, 16.60 tons.
Weight of bagasse—550 lbs., Weight of juice 1110 lbs.
Extraction—66⅔ per cent., Bagasse 33⅓ per cent.

TREATMENT OF JUICE.

Limed to nearly neutrality, using 4.2 grammes to gallon, and concentrated in the Yaryan.

LABORATORY ANALYSES.

Kind of Product.	Degrees Baume.	Total Solids.	Sucrose.	Glucose.	Co-effi't Purity.	Glucose per cent Sucrose.
Raw juice	7.9	14.3	11.6	1.58	81.1	13.6
Limed juice	8.6	15.5	12.6	1.50	81.2	11.9
Concentrated juice	23.0	42.0	34.4	......	81.9	......
Molasses	40.0	75.3	52.3	8.00	......	......
Sugar	......	......	95.2	1.18	......	......
Skimmings	6.1	11.0	7.4	1.00	67.2	......

RESULTS IN SUGAR HOUSE.

The fugalman by accident dropped an unknown quantity of masse cuite in some molasses, and hence results obtained are too low. The following however were actually obtained:

59 lbs. sugar.
84 lbs. molasses.

Up to this point our efforts have been exerted in securing data with which to compare future experiments. Accordingly we have treated slightly acid, neutral and alkaline juices, using lime only, except with No. 1. We have clearly demonstrated that fresh juices limed to exact neutrality, suffer little or no inversion by concentration in a vacuum, and very little in the open

pan. In fact the cosfficient of purity rises with the concentration, provided the solids not sugar which rise to the surface or fall to the bottom, are removed. This is as it should be, since the coefficient of purity represents the proportion of sugar to total solids. Of the latter a portion of those not sugars, are either rendered insoluble and settle to the bottom, or are forced by the increasing specific gravity of the liquid to the top, and are removed by brush or otherwise. This liming to neutrality however gives dark colored products, a serious objection, so long as they are bought by color and not by their saccharine content. The rest of the experiments are therefore devoted to different clarifying agents accessible to the Station.

EXPERIMENTS WITH LIME AND SUPERPHOSPHATE OF LIME.

EXPERIMENT NO. 23.

Manures used—45 lbs. Tankage, applied May 24th, 1886.
Weight of cane—1790 lbs., Yield per acre 17.90 tons.
Weight of bagasse—5.76 lbs., Weight of juice 1214 lbs.
Extraction—67.8 per cent., Bagasse 32.2 per cent.

TREATMENT OF JUICE.

Limed to slight alkalinity, using 3.6 grammes per gallon ; settled and made slightly acid with superphosphate of lime. Concentrated in Yaryan.

LABORATORY ANALYSES.

Kind of Product.	Degrees Baume.	Total Solids.	Sucrose.	Glucose.	Co-effi't Purity.	Glucose per cent Sucrose.
Raw juice	8.6	15.5	11.9	1.46	76.7	12.3
Limed juice	8.9	16.0	13.2	1.38	82.5	10.4
Concentrated juice	20.0	36.4	27.8	3.76	76.3	13.2
Molasses	38.8	73.0	47.9	19.20	......	......
Sugar	......	......	95.5	1.59	......	......
Skimmings	......	......	6.2	1.00	.....	......

SUGAR HOUSE RESULTS.

88 lbs. Sugar polarizing...............95.5 per cent= 84.04 lbs. pure sugar.
86 lbs. Molasses polarizing...........47.9 per cent= 41.27 " " "
107 lbs. Skimmings polarizing......... 6.2 per cent= 6.63 " " "

Total sugar accounted for.................. 131.94 131.94 " " "
Total sugar in 1214 lbs. juice polarizing... 11.9 144.46 " " "

Loss by inversion, etc.,........... 12.52 " " "

This loss was a disappointment, and at first could not be accounted for, but our laboratory results soon revealed the rapid decline of coefficient of purity, and increase in glucose per centage of sucrose, in passing from limed to concentrated juice. A calculation will show that upon the amount of juice worked, that over ten pounds sre inverted in passing from limed juice of 82 per cent purity coefficient to concentrated syrup of 76 per cent purity. It is safe therefore to assume that most of this loss was due to inversion. But superphosphate of lime rightfully applied ought not to invert. An analysis of the article used was made, and found to contain a goodly amount of free sulphuric acid which had done the work. It was however used in a few other experiments and discarded. This was a commercial article and was bought in New Orleans.

EXPERIMENT NO. 24.

Manures used—45 lbs., Tankage applied Oct. 19th.
Weight of cane—1588 lbs., Yield per acre 15.88 tons.
Weight of bagasse—562 lbs. Weight of juice 1026 lbs.
Extraction—64.6 per cent, Bagasse 35.4 per cent.

TREATMENT OF JUICE.

Limed to slight alkalinity settled and clear juice made slightly acid with commercial superphosphate of lime, containing free sulphuric acid, lime used 4 grammes to gallon, concentrated in the Yaryan.

LABORATORY ANALYSES.

Kind of Product.	Degrees Baume.	Total Solids.	Sucrose.	Glucose.	Co-efficient of Purity.	Glucose per cent Sucrose.
Raw juice	8.6	15.5	12.1	1.50	78.0	12.4
Limed juice	8.6	15.5	13.0	1.54	83.8	11.8
Concentrated juice	20.7	37.8	28.7	4.08	75.8	14.2
Molasses	......	......	......	......	......	......
Sugar	......	......	90.1	......	......	......
Skimmings	5.9	10.7	6.6	......	......	......

SUGAR HOUSE RESULTS.

74 lbs. Sugar, 64 lbs. molasses and 202 lbs. skimmings.

The sample of molasses from some cause was not taken, hence no calculation of results can be made. Inversion was large as is proved by comparing the co-efficient of purity of the limed and concentrated juice; the glucose per cent of sucrose also increases greatly.

EXPERIMENT NO. 25.

Manures used—45 lbs. Tankage and 15 lbs. Kainite.
Yield of cane—1842 lbs., Yield per acre 18.42 tons.
Yield of Bagasse 604 lbs., Yield of juice 1238 lbs.
Extraction—67.2 per cent, Bagasse 32.8 per cent.

TREATMENT OF JUICE.

Limed to alkalimity, using 3.8 grammes to the gallon, settled and clear juice made neutral, with commercial superphosphate of lime.

LABORATORY ANALYSES.

Kind of Product.	Degree Baume.	Tottal Solids.	Sucrose.	Glucose.	Co-efficient of Purity.	Glucose per cent Sucrose.
Raw juice	8.9	16.1	12.5	1.16	77.6	9.3
Limed juice	8.9	16.1	13.0	1.04	80.7	8.0
Concentrated juice	24.3	44.5	36.	3.96	80.9	11.0
Molasses	39.4	74.1	51.6	16.20	.....	......
Sugar	......	......	96.2	.70	......	......
Skimmings	5.9	10.7	6.8	.60	63.5	......

SUGAR HOUSE RESULTS.

90 lbs. Sugar polarizing	96.2 per cent=	86.50	lbs. pure sugar
93 lbs. Molasses "	51.6 per cent=	47.98	" " "
185 lbs. Skimmings "	6.8 per cent=	12.58	" " "
Total sugar accounted for		147.14	" " "
Total sugar in 1238 lbs. juice @	12½=	154.65	" " "
Loss		7.51	" " "

Here the loss was not entirely by inversion, as following glucose calculations will show:

1238 lbs. Juice @	1.16=		14.36 lbs.
Amount found in—			
90 lbs. Sugar @	.7=	.63	
93 lbs. Molasses @	16.2=	15.06	
185 lbs Skimmings	.6=	1.11	16.80
Gain in glucose			2.44 lbs.

Equal to loss of sucrose of 2.32 lbs., leaving 5.19 lbs of sucrose unaccounted for.

EXPERIMENT NO. 26.

Manures used—45 lbs. Tankage, 15 lbs. Kainite, and 10 lbs. Gypsum.
Yield of cane—1932 lbs., Yield per acre 17.32 tons.
Yield of bagasse—580 lbs., Yield of juice 1354 lbs.
Extraction –70 per cent., Bagasse 30 per cent.

TREATMENT OF JUICE.

Limed to alkalinity, using 3 grammes to the gallon, settled, and to the clear juice added commercial superphosphate of lime to slight acidity.

LABORATORY ANALYSES.

Kind of Product.	Degrees Baume.	Total Solids.	Sucrose.	Glucose.	Co-effi't Purity.	Glucose per cen-
Raw juice........................	9.	16.3	13.	1.04	79.1	8.
Limed juice........................	9.2	16.6	13.6	1.08	81.9	10.
Concentrated juice............. ...	23.8	43.6	33.9	3.95	77.7	11.65
Molasses	......	......	55.3	14.30	......	......
Sugar........................	......	......	96.5	.42	......	......
Skimmings........................	6.7	12.	8.5	.85	70.8	......

SUGAR HOUSE RESULTS.

92 lbs. Sugar polarizing................96.5 per cent= 88.88 lbs pure sugar
115 lbs. Molasses polarizing............55.3 per cent= 63.59 " " "
203 lbs. Skimmings polarizing.......... 8.5 per cent= 17.25 " " "

Total sugar accounted for................ 169.72 " " "
Total sugar in 1354 lbs. juice polarizing..13. per cent=176.02 " " "

Loss .... 6.30 " " "

GLUCOSE.

92 lbs. Sugar @...................... .42 = .39
115 lbs. Molasses @.................. 14.3 =16.44
203 lbs. Skimmings @................ .85 = 1.72

Total sugar recovered................. 18.55 lbs
Total sugar in 1354 lbs. juice @....... 1.04 =14.08

Gain by inversion................ 4.47 lbs=4.25 lbs. pure sugar.

Loss unaccounted for........... 2.05 " " "

To test further the accuracy of this loss, the following theoretical calculations were made. The skimmings containing everything removed from the juice during concentration, are taken from raw juice and the remainder should be in the concentrated juice, sent into the strike pan.

We have the following lbs. of each in the juice worked :

Kind of Produce.	Total Solids.	Sucrose.	Glucose.	Co-efficient of Purity.
Raw juice........................	220.70 lbs.	176.02 lbs.	14.08 lbs.	79.1
Skimmings........................	24.36 "	17.25 "	1.72 "	70.8
Total	196.34 lbs.	158.77 lbs.	12.36 lbs.	by diffe'ce

Left in the syrup worked, giving by calculation a co-efficient of purity equal to 80.84. But 1554 lbs. of juice at 9° Baume, when concentrated to 23.8° Baume, will weigh 448 lbs., and from analyses we find it contains 196.34 lbs. total solids, 152.55 lbs. sucrose, and 17.69 lbs. of glucose, showing a decrease of 6.22 lbs. of sucrose and an increase 5.33 lbs. of glucose, but the inversion of 6.22 lbs. sucrose would give 6.54 lbs. of glucose. Hence 6.54 less 5.33=1.21 lbs., is the apparent loss in glucose.

A cimilar calculation upon the glucose per cent of sucrose will give nearly same results.

In raw juice the glucose per cent is 8.

In skimmings the glucose per cent is 10.

In concentrated juice the glucose per cent is 11.65.

Taking these and multiplying by the amount of sucrose in each and we have glucose:

In raw juice		14.08 lbs.
In skimmings	1.72	
In concentrated juice	17.70	19.52 lbs.
		5.32 increase in glucose.

Here theory shows that our inerease in glucose should be 5.32 lbs. and our wotk shows it to be actually 4.47 lbs. Theory shows 1.21 sucrose nnaccounted for, while our practice shows an unaccountable balance of a little over two lbs. Here we wish to emphasize the fact, that a slight acidity, caused an inversion of 4 to 6 lbs. upon a possible quantity of 15.8 lbs. of sugar, or 2 to 4 per cent upon the sugar worked. But the agent was the energetic sulphuric acid.

EXPERIMENT NO. 27.

Manures used—45 lbs. Tankage, 15 lbs. Cotton Hull Ashes.
Yield of cane—1640 lbs., Yield per acre 16.40 tons.
Weight of bagasse—589 lbs., Weight of juice 1051 lbs.
Extraction—64.1 per cent., Bagasse 35.9 per cent.

TREATMENT OF JUICE.

(Like No. 26.)

LABORATORY ANALYSES.

Kind of Product.	Degrees Baume.	Total Solids.	Sucrose.	Glucose.	Co-eff't Purity.	Glucose per cent Sucrose.
Raw juice	8.7	15.7	12.4	1.27	78.9	10.2
Limed juice	9.2	16.6	13.6	1.41	81.9	10.3
Skimmings	4.3	7.8	5.2	.65	66.6	....

SUGAR HOUSE RESULTS.

This experiment was used in a public test of the Yaryan Distilling Apparatus, and was converted by it into syrup. No sugar made.

Experiments Nos. 28 and 29 were also made into syrup.

These experiments closed the use of commercial superphosphate of lime, and point conclusively to the loss which may be sustained by its use. Further on we gave a method of manufacturing at home a pure article, quite devoid of free sulphuric acid, which gave better results.

Experiments in the use of SULPHUR as a defacating agent were next instituted.

EXPERIMENT NO. 30.

Manures used—85 lbs. Cotton seed, and 15 lbs. Acid Phosphate.
Yield of cane—1540 lbs , Yield per acre 15.40 tons.
Yield of bagasse—558 lbs., Yield of juice 982 lbs.
Extraction—63.8 per cent., Bagasse 36.2 per cent.

EXPERIMENT NO. 31.

Was worked up with No. 30 in the sugar house with
Manures used—85 lbs. Cotton seed, 15 lbs. Acid Phosphate, and 15 lbs. Kainite.
Yield of cane—1700 lbs., Yield per acre 17.00 tons.
Yield of bagasse—586 lbs., Yield of juice 11.14 lbs.
Extraction—65.6 per cent., Bagasse 34.4 per cent.

TREATMENT OF ABOVE JUICES.

Sulphured, limod, and left acid, using 4 grammes to the gallon and concentrated in the Yaryan.

LABORATORY ANALYSES.

Kind of Product.	Degrees Baume.	Total Solids.	Sucrose.	Glucose.	Glucose per cent Sucrose.	Co-effi't Purity.
Raw juice No. 30	8.7	15.7	12.8	1.38	10.8	81.5
Sulphured juice No. 30	8.7	15.7	12.8	1.40	10.9	81.5
Raw juice No. 31	8.9	16.	13.6	1.00	7.3	85.
Sulphured juice No. 31	8.7	15.7	13.	1.15	8.3	82.8
Limed juice (both)	8.	14.4	12.1	1.27	10.5	85.5
Concentrated juice (both)	16.5	30.0	23.	2.82	12.3	76.6
Molasses both	34.5	64.3	41.1	11.33	......	......
Sugar	......	......	90.6	3.28	......	......
Skimmings	8.1	14.6	8.7	1.00	......	......

SUGAR HOUSE RESULTS.

163 lbs. Sugar polarizing......................90.6=146.70 lbs. pure sugar.
207 lbs. Molasses polarizing..................41.1= 85.07 " " "
202 lbs. Skimmings @........................ 8.7= 17.57 " " "

Total accounted for	249.34
Total in raw juice	267.19
Loss	17.85

EXPERIMENT NO. 32.

Manures used—85 lbs. Cotton seed, 15 lbs. Cotton Hull Ashes.
Yield of Cane—16.84 lbs., Yield per acre 16.84 tons.
Yield of Bagasse—584 lbs., Yield of juice 1100 lbs.
Extraction—65.3 per cent., Bagasse 34.7 per cent.

TREATMENT OF JUICE.

Sulpured and limed, using 2.8 grammes per gallon and left slightly acid.

LABORATORY ANALYSES.

Kind of Product.	Degree Baume.	Total Solids.	Sucrose.	Glucose.	Co-efficient of Purity.	Glucose per cent Sucrose.
Raw juice	8.1	14.6	11.1	1.5	76.	13.5
Sulphured juice	8.1	14.6	11.	1.54	75.3	14.
Limed juice	8.2	14.8	11.8	1.65	79.7	14.
Concentrated juice	24.4	44.8	34.6	5.84	77.2	16.8
Molasses	26.4	48.5	41.38	16.46	......	......
Sugar	......	......	95.20	1.02	......	......
Scums	4.4	8.0	2.2	.33	......	......

SUGAR HOUSE RESULTS.

72 lbs. Sugar polarizing......................95.2 =	68.54	lbs.	pure	sugar
102½ lbs. Molasses " ....41.38=	42.41	"	"	"
104½ lbs. Skimmings " .... 2.2 =	2.29	"	"	"
Total accounted for......................	113.24	"	"	"
Total present 1100 lbs. juice @............11.1=	122.10	"	"	"
Loss..	8.86	"	"	"
Of this amount there was inverted.........	3.60	"	"	"
Balance unaccounted for..................	5.26	"	"	"

In this experiment Kroogs' Filter Press was used to filter the scums, after the addition to them of 3 lbs. pulverized charcoal.

The masse cuite from above weighed 151 lbs., from which was obtained 72 lbs. sugar=47 per cent.

In working this acid juice a small amount of lime water was introduced into the strike pan to prevent excessive foaming.

The pulverized charcoal used here and elsewhere, was kindly donated by Leeds & Co., of New Orleans.

EXPERIMENT NO. 33.

Manures used—23⅓ lbs. Cotton meal, 11⅔ lbs. Acid phosphate.
Yield of cane—1724 lbs., Yield per acre 17.24 tons.
Yield of bagasse— 636 lbs., Yield of juice 1088 lbs.
Extraction—63.1 per cent., Bagasse 36.9 per cent.

TREATMENT OF JUICE.

Sulphured and limed, using 2.8 grains to gallon and left quite acid; concentrated in the Yaryan.

LABORATORY ANALYSES.

Kind of Product.	Degrees Baume.	Total Solids.	Sucrose.	Glucose	Co-eff't Purity.	Glucose per cent of Sucrose.
Raw juice...........................	8.3	15.	11.8	1.42	78.6	12.
Sulphered juice....................	8.2	14.8	11.2	1.54	75.6	13.7
Limed juice.........................	7.6	13.7	11.0	1.59	80.3	14.5
Concentrated juice.................	24.	43.9	33.3	5.66	75.8	17.0
Molasses	40.	75.4	42.1	22.17	......	......
Sugar................................	......	......	96.1	1.09	......	......
Skimmings..........................	4.6	4.6	5.0	.72	......	......

SUGAR HOUSE RESULTS.

79 lbs. sugar polarizing	96.1=	75.92	lbs. pure sugar
85 lbs. molasses polarizing	42.1=	35.78	" " "
121 lbs. skimming polarizing	5.0=	6.05	" " "
Total sugar accounted for		117.75	" " "
Total sugar in 1088 lbs. juice polarizing	11.8=	128.38	" " "
Loss by inversion, etc		10.63	" " "

By a theoretical calculation based on laboratory analyses, the amount of inversion was about 10 lbs.

EXPERIMENT NO. 34.

Manures used—85 lbs. Cotton Seed and 15 lbs. Floats.
Yield of cane—1556 lbs., Yield per acre 15.56 tons.
Yield of bagasse—540 lbs., Yield of juice 1016 lbs.
Extraction—65.3, Bagasse 34.7.

TREATMENT OF JUICE.

Sulphured and left very acid, using 2.3 grammes of lime per gallon; concentrated in the Yaryan.

LABORATORY RESULTS

Kind of Product.	Degrees Baume.	Total Solids.	Sucrose.	Glucose.	Co-effi't Purity.	Glucose per cent of Sucrose.
Raw juice	8.5	15.4	11.9	1.24	77.2	10.4
Sulphured juice	8.1	14.6	11.4	1.50	78.	13.1
Concentrated juice	22.8	41.7	26.3	5.10	70.2	17.4
Molasses	28.	71.3	47.6	16.43	......	......
Sugar	......	......	05.7	1.78	......	......
Skimmings	3.3	6.	2.9	.36	......	......

SUGAR HOUSE RESULTS.

60 lbs. Sugar @	95.7=	57.42	lbs. pure Sugar.
102 lbs. Molasses @	47.6=	48.55	" " "
99½ lbs. Skimmings @	2.9=	2.88	" " "
Total sugar accounted for		108.85	" " "
Total sugar in 1016 lbs. juice @	11.9=	120.90	" " "
Loss by inversion, etc		12.05	" " "

Both the reduction in purity coefficient and the increase in glucose per centage of sucrose show a heavy less.

In this experiment the Kroog's filter press was used for filtering the skimmings without the intervention of any medium.

EXPERIMENT NO. 35.

Manures used—85 lbs. Cotton Seed, 15 lbs. Floats, and 10 lbs. Gypsum.
Yield of Cane—1850 lbs., Yield per acre 18.50 tons.
Yield of Bagasse—640 lbs., Yield of juice 1210 lbs.
Extraction—65.4, Bagasse 34.6.

TREATMENT OF JUICE.

Sulphured and left very slightly acid, using 2.6 grammes lime; concentrated in the Yaryan.

LABORATORY ANALYSES.

Kind of Product.	Degrees Baume.	Total Solids.	Sucrose.	Glucose.	Co-effi't Purity.	Glucose per cent of Sucrose.
Raw juice	8.2	14.8	11.	1.34	74.3	12.2
Sulphured juice	8.3	14.9	11.1	1.41	74.4	12.7
Limed juice	8.2	14.8	11.1	......	74.5	......
Concentrated juice	25.	45.9	33.4	4.86	72.7	14.5
Molasses	38.8	73.	45.6	17.60	62.4	......
Sugar	......	......	97.1	.90	......	......
Skimmings	4.5	8.1	4.2	.50	......	......

SUGAR HOUSE RESULTS.

77 lbs. Sugar polarizing	97.1=	74.76	lbs.	pure	Sugar.
94 lbs. Molasses polarizing	45.6=	42.86	"	"	"
201 lbs. Skimmings polarizing	4.2=	8.46	"	"	"
Total sugar accounted for		126.08	"	"	"
Total sugar in 1210 lbs. juice @	11.6=	133.10	"	"	"
Loss by inversion, etc		7.02	"	"	"

Here the loss by inversion was about three lbs., leaving the rest unaccounted for.

EXPERIMENTS NOS. 36, 37, 38, 39, 40.

Manures used—Stable Manure, with and without Acid Phosphate and Floats.
Yield of cane—1940 lbs.
Yield of Bagasse—770 lbs., yield of juice 1170 lbs.
Extraction—60.3, Bagrsse 39.7.

TREATMENT OF JUICE:

Sulphured and limed to neutrality, using 3.3 grammes of lime per gallon.

LABORATORY ANALYSES.

Kind of Product.	Degrees Baume.	Total Solids.	Sucrose.	Glucose.	Co-effi't Purity.	Glucose per cent of Sucrose.
Sulphured juice	8.4	15.2	11.5	1.12	75.6	9.7
Concentrated juice	24.5	44.9	33.5	4.63	74.6	13.8
Molasses	38.	71.2	46.5	18.20	65.3	......
Sugar	......	......	96.2	.85	......	......
Skimmings	4.6	8.3	6.5	.75	......	......

SUGAR HOUSE RESULTS.

74 lbs. Sugar polarizing.....................96.2= 70.18 lbs. pure Sugar.
91.5 lbs. Molasses polarizing..................46.5= 42.54 " " "
136 lbs. Skimmings polarizing................ 6.5= 8.84 " " "

121.56 " " "

In this experiment a small portion of syrup was lost. The inversion however amounted to 1½ and 2½ lbs.

This completes Plat No. 2. The size of each experiment except Nos. 36, 37, 38, 39 and 46, was 1-20 of an acre, these 1-60.

The next plat worked was No. 7, and here on account of smaller size of the experiments and the lateness of the season, several field experiments were worked together in the sugar house.

PLAT VII.

PHOSPHORIC ACID.

EXPERIMENTS 1, 6, 7.

Manures used—On each, 18 lbs, Cotton Seed Meal, and 18 lbs. Kainite.
Yield of Cane—2346 lbs., Yield per acre 14.67 tons.
Yield of Bagasse— 754 lbs., Yield of juice 1592 lbs.
Extraction—67.9, Bagasse 32.1.

TREATMENT OF JUICE.

Sulphured and limed, using 3.1 grammes per gallon, and left slightly acid.

LABORATORY RESULT.

Kind of Product.	Degsees Baume.	Total Solids.	Sucrose.	Glucose.	Co-effi't Purity.	Glucose per cent Sucrose.
Raw juice No. 1....................	8.7	15.7	12.7	1.13	80.8	8.89
Raw juice No. 6....................	8.6	15.5	12.5	1.01	80.6	8.56
Raw juice No. 11....................	8.7	15.7	12.7	1.10	80.8	8.66
Sulphured juice (all)...............	8.7	15.7	12.6	1.21	80.2	9.60
Limed juice (all....................	10.6	19.2	12.2	1.50	79.1	10.46
Concentrated juice (all).	26.0	47.8	37.7	5.35	78.8	11.24
Molasses (all)......................	......	......	55.2	15.00	......	27.17
Sugar (all).........................	......	......	92.4	.85	......	.91
Skimmings (all).....................	7.9	14.3	9.3	.90	......	9.67

In the above, the limed juice was partially concentrated before sample was taken.

SUGAR HOUSE RESULTS.

Here a loss of a portion of the syrup prevented accurate calculation, but in the masse cuite obtained and the glucose ratio to sucrose was determined, and applying this to the total amount of sugar in the juice, after that in Skimmings had been deducted, and we have a loss of 9½ lbs. by inversion, viz.:

	Sucrose.	Glucose.
In raw juice..........................	295.31	25.81
In Skimmings..........................	14.25	1.47
Leaving	281.06	24.34—or a ratio 8.3
In masse cuite we find................	271.47	33.93—or a ratio 12.5
Loss by inversion..................	9.59	

EXPERIMENTS 2, 4, 5.

Manures used—Basal Mixture with ⅓, ⅔, and one ration of Dissolved Bone Black.

Yield of cane—2846 lbs., Yield per acre 17.76 tons.
Yield of Bagasse—1069 lbs., Yield of juice 1777 lbs.
Extraction—62.5, Bagasse 37.5.

TREATMENT OF JUICE.

Sulphered and limed in excess, using 3.8 grains per gallon.

LABORATORY ANALYSES.

Kind of Product.	Degrees Baume.	Total Solids.	Sucrose.	Glucose.	Co-effi't Purity.	Glucose per cent Sucrose.
Raw juice No. 1	8.8	15.9	13.2	1.27	83.	9.62
Raw juice No. 4	8.5	15.4	11.8	1.30	76.6	11.01
Raw juice No. 5	8.6	15.5	12.3	1.34	79.3	10.89
Sulphured juice (all)	8.5	15.4	11.9	1.29	77.2	10.84
Limed juice (all)	8.4	15.2	11.5	1.30	75.6	11.30
Concentrated juice (all)	25.0	45.9	35.1	4.34	75.3	12.25
Molasses	37.5	70.2	44.0	17.90	62.6	40.68
Sugar	......	......	96.	.72	......	.75
Skimmings	5.2	9.4	8.6	.94	......	10.93

SUGAR HOUSE RESULTS.

144.5 lbs. Sugar polarizing..................96. =138.72 lbs. pure sugar.
140 lbs. Molasses polarizing..................44. = 61.60 " " "
151 lbs. Skimmings polarizing................ 8.6= 12.98 " " "

Total accounted for...................... 213.30 " " "
Total present in the beginning........... 221.47 " " "

Loss by inversion, etc.................... 8.17 " " "
Gain in Glucose..........................4.31= 4.00 lbs. sugar inv't.

Loss unaccaunted for.................. 4.08 lbs. pure sugar.
The above juice had.. .48 Ash.
The above molasses had.. 5.09 "
Containing Potash..37·57 "
Soda..11.41 "
Lime .... 4.39 "
Phosphoric Acid.. 2.48 "
Sulphuric Acid... 9.45 "

EXPERIMENTS NOS. 3, 8 and 13.

Manures used—None.
Weight of cane—2558 lbs.; Yield per acre, 13.47 tons.
Yield of bagasse—790 lbs., Yield of juice 1768 lbs.
Extraction—69.1 per cent, Bagasse 30.1 per cent.

TREATMENT OF JUICE.

Sulphured, limed, using 2.3 grammes per gallon and left very moderately acid.

LABORATORY ANALYSES.

Kind of Product.	Degrees Baume.	Total Solids.	Sucrose.	Glucose.	Co-effi't Purity.	Glucose per cent of Sucrose.
Raw juice No. 3	8.6	15.5	12.1	1.42	78.0	11.73
Raw juice No. 8	8.5	15.4	11.6	1.36	75.3	11.72
Raw juice No. 11	8.5	15.4	12.1	1.46	78.3	12.06
Sulphured juice [all]	8.5	15.4	11.4	1.42	74.0	12.45
Limed juice "	11.4	20.6	15.4	2.21	74.7	14.35
Concentrated juice [all]	30.6	56.6	41.6	5.66	73.5	13.60
Molasses "	40.0	75.4	48.4	17.00	......	35.12
Sugar "	......	......	95.8	1.00	......	1.04
Skimmings "	6.5	11.7	7.1	1.00	......	14.05

SUGAR HOUSE RESULTS.

Here the syrup coming from the Yaryan was weighed as well as analysed, to test whether there was any loss by overflow, with follewing results:

516 lbs. syrup, containing 214.65 lbs. sucrose and 29.20 lbs. glucose, showing no loss in overflow, giving as final results:

136 lbs. Sugar polarizing	95.8	= 130.28	lbs. pure sugar.
168 lbs. Molasses polarizing	48.4	= 81.31	" " "
134 lbs. Skimmings polarizing	7.1	= 9.51	" " "
Total sugar accounted for		221.10	" " "
Total in raw juice		225.67	" " "
Loss by inversion, etc		4.57	" " "
The gain in glucose was	5.66 lbs	=5.37	" " "
Total gain unaccounted for		.80	lbs. glucose

EXPERIMENTS NOS. 7, 9, 10.

Manures used—Basal Mixtures ⅓, ⅔ and 1 ration, of Acid Phosphate.
Yield of cane—2620 lbs., Yield per acre 17.08 tons.
Yield of Bagasse—834 lbs., Yield of juice 1786 lbs.
Extraction—68.2 per cent, Bagasse 31.8 per cent.

TREATMENT OF JUICE.

Sulphured and limed to neutrality, using 5.1 grammes per gallon.

LABORATORY ANALYSES.

Kind of Product.	Degree Baume.	Total Solids.	Sucrose.	Glucose.	Co.effit. Purity	Glucose per cent. Sucrose.
Raw juice No. 7	8.5	15.4	12.8	1.06	83.1	8.28
Raw juice No. 9	8.4	15.2	12.0	1.13	78.9	9.41
Raw juice No. 10	8.2	14.8	11.5	1.02	77.7	8.87
Sulphured juice (all)	8.3	14.9	11.4	1.18	76.5	10.35
Limed juice (a l)	8.8	15.9	13.1	1.38	82.4	10.53
Concentrated juice (all)	26.0	47.8	36.2	4.74	75.7	13.09
Molasses	36.0	67.3	46.0	13.78	......	29.95
Sugar	......	......	95.8	·55	......	55
Skimmings	......	......	......	......	......	......

SUGAR HOUSE RESULTS.

A loss of a portion of the syrup and the failure to analyse the Skimmings prevented accurate calculation of results. There was however in the masse cuite obtained a glucose ratio of 13. while in raw juice it was 8.8, showing a decided inversion.

The above juice had	.44 ash.
The above Molasses	5.59 ash.
Containing Potash	36.06
Soda	7.32
Lime	2.81
Phosphoric Acid	2.58
Sulphuric Acid	11.94

EXPERIMENTS NOS. 12, 14, 15.

Manures used—Basal Mixture with ⅓, ⅔ and 1 ration of Precipitated Bone Black.

Yield of cane—2206 lbs., Yield per acre 13.79 tons.

Yield of Bagasse—716 lbs., Yield of juice 1490 lbs.

Extraction—67.6 per cent, Bagasse 32.4 per cent.

TREATMENT OF JUICES.

Sulphured and limed, using 3 grammes per gallon and left acid.

LABORATORY ANALYSES.

Kind of Product.	Degrees Baume	Total solids.	Sucrose.	Glucose.	Co-effit. Purity	Glucose per cent Sucrose.
Raw juice No. 13	8.6	15.5	12.5	1.10	80.6	8.8
Raw juice No. 14	8.6	15.5	12.5	1.13	80.6	9.04
Raw juice No. 15	8.4	15.2	12.3	1.02	80.8	8.13
Sulphured juice (all)	8.4	15.2	12.3	1.24	80.8	10.08
Limed juice (all)	8.5	15.4	12.3	1.45	79.8	11.78
Concentrated juice (all)	27.0	49.7	37.4	5.30	75.2	14.17
Molasses (all)	39.0	73.4	48.3	16.45	......	34.05
Sugar (all)	......	.....	92.2	1.16	......	12.58
Skimmings	9.1	15.5	10.8	1.34	......	12.4

SUGAR HOUSE RESULTS.

Here again in working acid juice our little pan boiled over and lost an unknown portion of syrup, which prevents calculation of results. But the glucose ratio in the masse cuite obtained, as well as coefficient of purity, indicated a considerable loss by inversion.

The above juice had	.58 of ash
The Molasses had	—— of ash.
Containing Potash	34.84
Soda	5.20
Lime	3.91
Phosphoric Acid	2.60
Sulphuric Acid	10.34

EXPERIMENTS NOS. 17, 19, 28.

Manures used—Basal mixture with ⅓, ⅔ and 1 Rations Precipitated Acid Phosphate.

Yield of cane—2342 lbs ; Yield per acre, 14.66 tons.
Yield of bagasse—822 lbs., Yield of juice 1520 lbs.
Extraction—65 per cent, Bagasse 35 per cent.

TREATMENT OF JUICE.

Sulphured and limed, using 3 grammes per gallon, and left very slightly acid.

LABORATORY ANALYSES.

Kind of Product.	Degree Baume.	Total Solids.	Sucrose.	Glucose.	Co-efficient of Purity	Glucose per cent of Sucrose.
Raw juice No. 17	8.5	15.4	12.1	1.21	78.5	10.00
Naw juice No. 19	8.3	15.0	11.3	1.13	75.3	10.00
Raw juice No. 20	8.4	15.2	11.6	1.17	76.3	10.08
Sulphured juice [all]	8.3	15.0	11.2	1.24	74.6	11.07
Limed juice [all]	8.2	14.8	12.0	1.17	81.0	9.75
Concentrated juice [all]	26.0	47.8	36.2	4.74	75.7	13 09
Molasses [all]	......	......	......	......	......	......
Sugar [all]	......	......	......	......	......	......
Skimmings [all]	6.8	12.3	8.1	.85	......	10.49

SUGAR HOUSE RESULTS.

Were vitiated by failure to analyse molasses and sugar, though the glucose ratio and the purity co-efficient show considerable loss.

The above juice had .... .50 ash
The above molasses had .... — ash
Containing—
- Potash 36.54
- Soda 3.86
- Lime 1.76
- Phosphoric acid 7.19
- Sulphuric acid 10.74

EXPERIMENT NOS. 22 24, 25.

Manures us‘d—Basal Mixture with ⅓, ⅔ and 1 ration of Bone Dust.
Yield of cane—2062 lbs., Yield per acre 12.89 tons.
Yield of Bagasse—650 lbs., Yield of juice 1412 lbs.
Extraction—68.5, Bagasse 31.5.

TREATMENT OF JUICE.

Sulphured and limed to nearly neutrality, using 2.2 grammes per gallon

LABORATORY ANALYSES.

Kinds of Product.	Degrees Baume	Total Solids.	Sucrose.	Glucose.	Co-effit. Purity	Glucose per cent Sucrose.
Raw juice No. 22	8.8	15.9	12.5	1.06	80.5	8.08
Raw juice No. 24	8.8	15.9	12.5	1.02	80 5	8.16
Raw juice No. 25	8.9	16.1	13.8	.91	85.7	6.59
Sulphured juice (all)	8.7	15.7	12.4	1.06	78.9	8.54
Limed juice (all)	10.4	18.8	15.0	1.42	79.7	9.46
Concentrated juice (all)	26.2	48.1	38.1	3.85	79.2	10.10
Molasses (all)	38.2	71.8	46.1	13.80	......	......
Sugar (all	......	......	95.8	.50	......	......
Skimmings	7.5	13.8	9.5	.84	......	......

SUGAR HOUSE RESULTS.

117 lbs. Sugar polarizing..............95.8 per cent=112.08 lbs. pure sugar
120 lbs. Molasses polarizing...........46.1 per cent= 55.32 " " "
90 lbs. Skimmings polarizing......... 9.5 per cent= 8.55 " " "

Total Sugar accounted for............. 175.95 " " "
Total in raw juice.................... 181.36 " " "

Loss by inversion, etc............ 5.41 " " "

117 lbs. Sugar @........................... .5 = .58 lbs. glucose
120 lbs Molasses @..............................13.8=16.58 " "
90 lbs. Skimmings @........................... .84 = .76 " "

Total recovered................................ 17.92
Total in raw juice............................. 13.98
Total gain..................................... 3.94
Which is equal to 3.74 lbs. Sucrose, leaving a loss of Sucrose unaccounted for=1.67 lbs.

The above juice had.. .49 ash
The above Molasses had..—— ash
Containing Potash..39.50
Soda.. 3.03
Lime 3.66
Phosphoric Acid.. 4.00
Sulphuric Acid.. 8.37

EXPERIMENTS NOS. 27, 29, 30.

Manures used—Basal mixture with ½, ⅔ and 1 rations of Floats.
Yield of cane—2022 lbs; Yield per acre, 12.64 tons.
Yield of bagasse—666 lbs., Yield of juice, 1356 lbs.
Extraction—67.1 per cent., Bagasse 32.9 per cent.

TREATMENT OF JUICE.

Sulphured and limed, using 1.9 grammes per gallon and left very acid.

LABORATORY ANALYSES.

Kind of Product.	Degree Baume.	Total Solids.	Sucrose.	Glucose.	Co-efficient of Purity	Glucose per cent Sucrose.
Raw juice No. 27.............. ...	8.9	16.1	13.1	1.06	81.03	8.09
Raw juice No. 29..................	8.6	15.5	12.4	1.18	80.00	9.51
Raw juice No. 30..................	8.6	15.5	12.4	1.16	80.00	9.35
Sulphured juice [all]..............	8.6	15.5	12.4	1.24	80.00	10.00
Limed juice [all]..................	9.2	16.6	14.1	1.42	84.90	10.07
Concentrated juice [all]............	27.0	49.6	37.8	5.10	76.02	13.49
Molasses [all]......................	38.5	72.4	45.0	16.40	......	36.42
Sugar [all].........................	......	......	92.4	1.59	......	17.20
Skimmings [all].....	7.4	14.0	7.0	1.00	......	14.28

SUGAR HOUSE RESULTS.

110 lbs Sugar polarizing..............92.4 per cent=101.64 lbs pure sugar
116 lbs Molasses polarizing............45.03 per cent= 52.23 lbs pure sugar
105 lbs Skimmings polarizing.........7.0 per cent = 7.35 lbs pure sugar

Total sugar accounted for..............................161.22 lbs pure sugar
Total in raw juice..171.15 lbs pure sugar

Total loss.. 9.93
Inversion by calculation from glucose ratio in masse cuite 6.16

Unaccounted for.................................... 3.77

EXPERIMENTS NOS. 32, 34, 35.

Manures used—Basal mixtures with ⅓, ⅔ and 1 rations of Orchilla Guano.
Yield of cane—1560 lbs., Yield per acre 9.75 tons.
Yield of bagasse—612 lbs., Yield of juice 948 lbs.

TREATMENT OF JUICE.

Sulphured, limed, using 2.1 grammes per gallon, and left very slightly acid.

LABORATORY ANALYSES.

Kind of Product.	Degrees Baume.	Total Solids.	Sucrose.	Glucose.	Coeficient of Purity.	Glu'se per ct Sucrose
Raw juice No. 32	8.8	15.9	12.9	1.02	81.1	7.90
Raw juice No. 34	8.7	15.7	13.0	1.02	82.8	7.84
Raw juice No. 35	7.6	13.7	11.3	.85	82.6	7.52
Sulphured juice [all]	8.7	15.7	12.6	1.06	80.2	8.41
Limed juice [all]	8.7	15.7	13.0	1.18	82.8	9.07
Concentr'd juice [all]	31.5	58.4	46.0	4.86	78.7	10.56
First sugar	41.0	77.3	50.6	13.00	......	25.69
Molasses	......	......	96.0	.79	......	.82
Skimmings	7.2	13.0	9.1	.80	......	9.34

SUGAR HOUSE RESULTS.

80 lbs. Sugar polarizing........................96.0=76.80 lbs. pure sugar
95.5 lbs. Molasses polarizing....................50.6=48.32 " " "
75 lbs. Skimmings polarizing .... 9.1=6.82 " " "

131.94

There is an inversion here of nearly 3 lbs sugar.

These experiments conclude our work with sulphur, and they positively show the injurious action of this reagent. Even juices after being treated with sulphur and limed to neutrality lose both in actual sugar house results and in theoretical calculations upon purity coefficients and glucose ratios. This loss from Sulphur increases in proportion to the acidity of juice worked. The great benefits to be derived from use of Sulphur, are our ability to work our juices more leisurely during warm weather, and to give us lighter colored products, but do these compensate for the losses of sugar sustained? These losses are from 2 per cent. upward, upon the actual sugar in the juices, and may even be in a very acid juice as high as 8 or 10 per cent. How this action takes place has been fully explained elsewhere.

But while sulphur is to be condemned, especially the reckless manner in which it is at present used in the sugar houses of this State, have we a substitute for it?

To solve this question the next experiments were made with

TANNIN,

as a purifying agent. Live Oak bark was used to furnish this

reagent. It was ground to a powder and the latter treated with ten times its weight of boiling water, two or three successive times in a clarifier. Each time, the clear solution after settling, was drawn off and used in the juice.

Two ways are suggested of using this reagent. 1st. To let the solution of oak bark run into the juice as it comes from the mill in sufficient quantities to saturate all the impurities of the juice. 2d. In the first clarifier heat the juice to about 105° or 110° F., and then pour in enough solution of oak bark to saturate the liquid and carry to gentle boiling. Withdraw the steam and the precipitate settles with great rapidity. Decant the very clear juice and treat with lime.

In both instances, only a slight excess of tannin should be used, which can easily be told by the following simple test. Get some white copperas, dissolve a very small quantity in water and to this solution add a drop or two of the treated juice. If an excess of tannin has been used, its presence will be quickly revealed by a black coloration (ink). The tannin first unites with all the albuminoids, etc., to form insoluble precipitates, and an excess over and above the amount needed for this purpose, remains dissolved in the juice, and its presence is revealed by the copperas. Either of these methods gives excellent results, the latter perhaps the best, while the former is the most expeditious.

EXPERIMENTS NOS. 18, 23,28, 33.

Manures used—None.
Yield of cane—2520 lbs., yield of juice—.
Yield of Bagasse— Extraction—.

TREATMENT OF JUICES.

Solution of oak bark added in insufficient quantity; limed to neutrality using 4 grammes per gallon, and made very slightly acid with pure superphosphate of lime.

Kind of Product.	Degree Baume.	Total Solids.	Sucrose.	Glucose.	Coefficient of Purity.	Glucose per cent Sucrose.
Raw juice No. 18	8.7	15.7	12.8	1.3	81.5	10.15
Raw juice No. 23	8.6	15.5	12.7	1.3	81.9	10.23
Raw juice No. 28	8.8	15.9	12.9	1.16	81.1	8.99
Raw juice No. 33	8.4	15.2	12.	1.34	78.1	11.16
Tannic Acid (all)	8.2	14.8	12.	1.21	81.0	10.08
Limed juice (all)	8.5	15.4	12.5	1.45	81.1	11.6
Concentrated juice (all)	26.7	49.0	40.0	4.96	81.6	12.4
Molasses (all)	39.0	73.3	43.9	16.40	......	37.36
Sugar (all)	......	......	97.0	.85	......	.87
Scimmings (all)	......	......	8.8	1.27	......	14.43
Settlings (all)	4.5	8.1	5.2	1.02	......	19.61

SUGAR HOUSE RESULTS.

120 lbs. Sugar polarizing	97.	=116.40	lbs. pure sugar
112 lbs. Molasses polarizing	43.9=	49 16	" " "
238 lbs. Settlings	5.2=	12.37	" " "
42 lbs. Skimmings polarizing	8.8=	3.69	" " "
Total sugar accounted for		181.62	" " "

Neither the bagasse nor the weight of juice were recorded and hence no way of knowing the accuracy of our results.

Here both purity coefficient and glucose ratio indicate successful treatment. This juice was treated with oak bark solution Monday morning, but was not concentrated till Tuesday evening. Maximum Temperature for the day 52° F.

A good even grain of good size, nearly pure white, are the remarks of the Assistant at the vacuum pan, recorded in the sugar book. The analysis shows it to contain 97 per cent. pure sucrose.

The juice contained	.47	of ash.
The Molasses contained	3.85	of ash
Containing Potash	42.30	
Lime	5.54	
Phosphoric Acid	1.98	
Sulphuric Acid	7.82	

EXPERIMENTS NOS. 16, 21, 26, 31.

Manures used—Basal mixtures.
Yield of cane—2279 lbs, Yield of juice 1535 lbs.
Yield of bagasse 744 lbs.
Extraction 67.4 per cent.

TREATMENT OF JUICE.

Raw juice, as it came from the mill, was treated in slight excess with a 10 per cent solution of Oak Bark, then limed, using 3.5 grammes per gallon and left slightly acid.

LABORATORY ANALYSES.

Kind of Product.	Degree Baume.	Total Solids.	Sucrose.	Glucose.	Coefficient of Purity.	Glucose per cent of Sucrose.
Raw juice No. 16	8.9	16.1	12.7	.98	78.8	7.71
Raw juice No. 21	9.0	16.3	13.8	.92	80.6	6.66
Raw juice No. 26	9.0	16.3	13.4	.92	82.2	6.86
Raw juice No. 31	8.7	15.7	13.1	1.02	83.4	7.78
Tannic acid juice (all)	8.8	15.5	12.9	.85	83.2	6.59
Limed juice (all)	8.4	15.2	12.8	.94	84.2	7.34
Concentrated juice (all)	23.5	43.0	36.8	2.50	85.5	6.79
Molasses (all)	39.0	75.3	46.7	12.44	......	26.63
Sugar (all)	......	......	95.8	.72	......	.75
Scums (all)	3.2	5.8	4.6	.50	......	10.87
Settlings (all)	8.7	15.7	10.5	1.02	66.8	9.71

SUGAR HOUSE RESULTS.

A small portion of the juice was lost, but there was obtained

119.5 lbs. Sugar polarizing	95.8	= 114.48	lbs. pure sugar
100.5 lbs. Molasses "	46.7	= 46.93	" " "
117½ lbs Settlings polarizing	10.5	= 12.33	" " "
94 lbs Scums polarizing	4.6	= 4.32	" " "
		178.06	

From the co-efficients of purity and the glucose per cent of sucrose in the raw juice and the masse cuite, we found very little inversion.

The molasses from this experiment gave 4.76 per cent ash, containing

Potash	36.55 per cent
Lime	7.87 per cent
Phosphoric Acid	3.62 per cent
Sulphuric Acid	9.81 per cent

PLAT VIII.

POTASSIC MANURES.

EXPERIMENTS NOS. 6, 11, 16, 21, 26.

Manures used—(18 lbs. Cotton Seed Meal and 15 lbs. Acid Phosphate) Meal Phosphate.

Yield of cane—3160 lbs., weight of Bagasse 1106 lbs.

Yield of juice—2054 lbs., Extraction 65 per cent.

TREATMENT OF JUICE.

Solution of oak bark added in slight excess, limed to neutrality, using 4 grammes per gallon, and made acid with pure superphosphate of lime (home made.)

LABORATORY ANALYSES.

Kind of Product.	Degrees Baume.	Total Solids.	Sucrose.	Glucose.	Co-effi't Purity.	Glucose per cent Sucrose.
Raw juice No. 6....................	9.2	16.6	14.	.85	84.3	6.71
Raw juice No. 11....................	9.2	16.6	13.8	.92	83.1	6.66
Raw juice No. 16....................	9.	16.2	13.6	1.02	83.9	7.50
Raw juice No. 21....................	8.3	15.0	11.8	1.21	78.6	0.25
Raw juice No. 26....................	8.5	15.4	11.8	1.20	76.6	10.17
Tannic Acid juice (all)..............	7.8	14.0	11.8	.92	80.2	7.79
Limed juice (all)....................	7.1	12.8	10.5	.92	82.0	8.76
Concentrated juice (all)............	29.	53.5	42.2	4.00	78.8	9.47
Molasses (all)........................	38.	71.3	42.8	14.10	......	32.94
Sugar(all)............................	......	......	95.1	.63	......	.66
Skimmings (all)....................	......	......	10.1	1.96	......	19.40

The molasses from these experiments were mixed with that from

EXPERIMENTS 8, 13, 18, 23, 28.

Manures used—None.

Yield of cane—4348 lbs., yield of Bagasse 1520 lbs.

Yield of juice—2828 lbs.

TREATMENT OF JUICES.

Oak bark solution, not quite to saturation; limed to neutrality, using 4.3 grammes per gallon, and made slightly acid with superphosphate of lime (home made).

LABORATORY ANALYSES.

Kind of Product.	Degrees Baume.	Total Solids.	Sucrose.	Glucose.	Coefficient of purity.	Glucose per cent of Sucrose.
Raw juice No. 8	8.6	15.5	12.5	1.27	80.9	10.16
Raw juice No. 13	8.5	15.4	12.4	1.27	80.5	10.25
Raw juice No. 18	8.3	15.0	11.7	1.34	78.5	11.45
Raw juice No. 23	8.0	14.4	11.2	1.34	77.7	11.96
Raw juice No. 28	8.3	14.9	11.1	1.30	74.5	12.61
Tannic acid juice [all]	7.8	14.0	10.8	1.13	77.7	10.46
Limed " "	7.5	13.6	11.0	1.21	80.8	11.00
Concent'ted " "	31.8	58.9	46.1	5.50	78.2	11.93
Molasses "	38.0	71.3	42.8	14.10	......	32.94
Sugar "	......	......	97.0	.85	......	.87
Scums "	......	......	6.8	.78	......	11.47
Settlings "	......	......	1.0	1.00	......	100.00

SUGAR HOUSE RESULTS.

In the first ezperiments there should be..............................272.08 lbs sucrose and 20.30 lbs glucose
The settlings and scums contained.. 37.74 " " and 7.33 lbs glucose
Of the concentrated syrup there were 519 lbs, containing........218.02 " " and 20.76 lbs glucose

The glucose per cent of sucrose for raw juice is........................ 7.46
" " " " " " settlings and scums................19.04
" " " " " " concentrated juice.................. 9.05

In the settlings and scums, had there been maintained the same glucose ratio as existed in the raw juice, there would have been 41.74 lbs sucrose and 3.11 lbs glucose, showing an inversion of 4.00 lbs sucrose to make 4.21 glucose. Taking this from the raw juice, we have left 230.34 lbs sucrose and 17.19 lbs glucose, which, had there been no loss, should have been in the syrup. But we find 20.76 lbs glucose, an excess of 3.57 lbs, equal to 3.39 lbs sucrose, which, added to the amount found and subtracted from the amount which ought to be present, we have an unaccountable deficiency of 8.93 lbs in the syrup.

In the second experiments there should be.......................338.94 lbs sucrose and 36.65 lbs glucose
The settlings and scums contained.. 17.38 " " and 4.38 lbs glucose
Of the concentrated syrup there were 676.5 lbs, containing............311.89 " " and 37.20 lbs glucose

The glucose per cent of sucrose for raw juice is.................10.8 per cent
" " " " " " settlings and scums is......24.9 per cent
" " " " " " syrup is.....................11.9 per cent

Reducing the settlings to the same glucose ratio which exists in raw juice, and we find a loss of 2.15 sucrose inverted into 2.27 glucose. Subtracting these amended settlings from the raw juice, and we have 319.41 lbs sucrose and 34.54 lbs glucose, which amounts should be found in the syrup. We find, however, only 311.89 lbs sucrose and 37.20 lbs glucose. Taking the excess of glucose, 2.66 lbs, equal to 2.52 lbs sucrose, and adding to the amount found and subtracting from the amount which should be present, and we have 5.00 lbs deficiency unaccounted for in the syrup.

RESULTS IN SUGAR AND MOLASSES.

In first syrup, there were..........	218.02 lbs sucrose	and 20.76 lbs	glucose
In second syrup, there were........	311.89 " "	and 37.20 "	"
Total	529.91 " "	and 57.96 "	"

143.5 lbs Sugar polarizing	95.1..............	136.46 lbs	.90 lbs	glucose
173.0 " " "	97.0..............	167.81 lbs	1.88 "	"
48.0 " " "	97.0..............	46.56 lbs		
419.0 " Molasses "	42.8..............	179.33 lbs	59.07 "	"
Total recovered..................		530.16 lbs	60.85 "	"
Apparent gain..................		.25 " suc'e	2.89 "	"

RECAPITULATION OF RESULTS.

Cane ground—7580 lbs, Extraction 65 per cent.
Yield of juice—4882 lbs.

Amount Sucrose present in raw juice..................	611.02	
" " obtained in first Sugar, polarizing 100°.	350.83	=57.4 per cent
" " in molasses, polarizing 100°..........	179.33	=29.4 per cent
" " obtained in Skimmings...............	55.12	= 9.0 per cent
" " inverted in "	6.15	= 1.0 per cent
" " " from raw juice to syrup......	5.91	= 1.0 per cent
" " unaccounted for......................	13.61	= 2.0 per cent

The skimmings, etc., could easily have been worked over, but in this and some other instances we preferred analysing, weighing and throwing away than to mix with the pure juices.

EXPERIMENTS NOS. 7, 9.

Manures vsed—Meal Phosphate with ½ and rations ⅔ of Muriate Potash.

Yield of cane—2304 lbs., weight of Bagasse 792 lbs.
Yield of juice—1512 lbs., Extraction 65.7 per cent.

TREATMENT OF JUICE.

Addition to saturation of oak bark solution ; limed to neutrality, using 4.3 grammes per gallon, and made very acid with Superphosphate of Lime.

LABORATORY ANALYSES.

Kind of Product.	Degrees Baume.	Total Solids.	Sucrose.	Glucose.	Co-effi't Purity.	Glucose per cent Sucrose.
Raw juice No. 7	8.8	15.9	12.9	1.06	81.1	8.21
Raw juice No. 9	8.8	15.9	13.0	1.06	81.7	8.15
Tannic Acid (all)	7.4	13.4	11.0	1.00	82.0	9.09
Limed juice (all)	8.4	15.2	12.9	1.02	84.2	7.90
Concentrated juice (all)	24 0	44.0	34.3	4.50	77.9	13.11
Molasses (all)	41.3	78.0	47.2	23.70	......	50.21
Sugar (all)	......	......	95.8	.67	......	.69
Skimmings (all)	6.4	11.5	4.0	.30	......	7.50
Settlings (all	9.0	16.2	9.4	.78	......	8.29

SUGAR HOUSE RESULTS.

128 lbs. Sugar polarizing......................95.8=122.62 lbs. pure sugar.				
108 lbs. Molasses polarizing....................47.2= 50.97	"	"	"	
94 lbs. Settlings............................ 9.4= 8.83	"	"	"	
93 lbs. Skimmings polarizing.................. 4. = 3.72	"	"	"	
Total accounted for.......................... 186.14	"	"	"	
Total Sugar in juice.......................... 195.09	"	"	"	
Amount of loss............................... 8.95	"	"	"	

Total glucose in cane............................ 16.02
128 lbs. Sugar @.............................. .67 .85
108 lbs. Molasses @...........................23.7 25.59
94 lbs. Settlings @............................ .78 .73
93 lbs. Skimmings @........................ .3 .28

Total Glucose in products.................... 27.05
Excess due to inversion...................... 11.03

Which is equal to 10.47 lbs. Sucrose, making a gain of 1.52 lbs. of Sucrose. Here excess of Superphosphate has caused, as was expected, a large inversion.

The Molasses of this Experiment gave.............................. 4.76 ash.
Containing Potash... ....36.00
Lime 5.52
Phosphoric Acid.. 3.62
Sulphuric Acid... 7.91

EXPERIMENTS NOS. 12, 14.

Manures used—Meal Phosphate and ½ and ¾ rations of Kainite.
Yield of cane—2236 lbs., yield of Bagasse 764 lbs.
Yield of juice—1472 lbs. Extraction 34.1 per cent.

TREATMENT OF JUICE.

It was first sulphured in usual way, then solution of oak bark added to saturation, and limed to slight alkalimity, using ¾ grammes lime per gallon.

LABORATORY ANALYSES.

Kind of Product.	Degrees Baume.	Total Solids.	Sucrose.	Glucose.	Co-effi't Purity.	Glucose per cent Sucrose.
Raw juice No. 12	8.8	15.9	13.	1.06	81.7	8.15
Raw juice No. 14	8.7	15.7	12.6	1.04	80.2	8.25
Sulphured and Tannic Acid (all)	8.1	14.6	11.9	1.02	81.5	8.57
Limed (all)	9.0	16.2	13.0	1.45	80.2	11.15
Concentrated (all)	23.6	43.2	34.3	4.00	79.9	11.66
Molasses (all)	38.3	72.0	45.3	15.00	......	33.11
Sugar (all)	......	......	95.1	.61	......	.63
Skimmings (all)	......	......	9.4	.85	......	9.04
Settlings (all)	7.3	13.2	7.5	.94	......	12.53

SUGAR HOUSE RESULTS.

In the raw juice there were	188.44	lbs.	Sucrose	15.45	lbs.	Glucose
Deduct Settlings and Scums	23.77	"	"	2.72	"	"
Left in clarified juice	164.67	"	"	12.73	"	"
The syrup weighed 434 lbs cont'ug	149.73	"	"	17.36	"	"
105.5 lbs. Sugar at 94.1	100.33	"	"	.64	"	"
105 lbs. Molasses at 45.3°	47.56	"	"	15.75	"	"
Total in Sugar and Molasses	147.89	"	"	16.39	"	"
Excess of Glucose				3.66	"	"
Equal to Sucrose	3.48	"	"			
Total Sucrose recovered	175.14	"	"			
Unaccounted for	13.30	"	"			

No benefit accrued from the combination of these two reagents.

The above molasses had	4.66 ash
Containing Potash	51.48
Lime	3.54
Phosphoric Acid	2.27
Sulphuric Acid	13.92

EXPERIMENTS NOS. 17, 19.

Manures used—Meal Phosphate and ½ and ⅔ rations of Sulphate of Potash.

Yield of cane—1518 lbs, Yield of Bagasse 530 lbs.

Yield of juice—988 lbs, Extraction 65.1 per cent.

TREATMENT OF JUICES.

Treated with Oak Bark solution to saturation and limed to perfect neutrality' using 5 grammes per gallon.

LABORATORY ANALYSES.

Kind of Product.	Degree Baume.	Total Solids.	Sucrose.	Glucose.	Co-efficient Purity.	Glucose per cent of Sucrose.
Raw juice No. 17	8.8	15.8	13.1	1.3	82.9	9.91
Raw juice No. 19	8.7	15.7	12.9	1.27	82.1	9.83
Tannic acid juice	8.0	14.5	12.0	1.11	82.7	9.25
Limed juice	8.0	14.5	12.0	1.08	82.7	9.00
Concentrated juice	.....	46.8	38.6	3.76	82.5	9.74
Molasses	38.5	72.3	39.2	16.20	......	41.32
Sugar	......	......	95.1	1.00	......	1.05
Settlings	7.5	13.6	8.5	1.00	......	11.76
Scums	4.3	7.7	4.7	.50	......	10.63

SUGAR HOUSE RESULTS.

After this juice was limed to perfect neutrality, 640 lbs were accurately weighed, analysed and sent into the Yaryan and concentrated to syrup, weighed again and sent to the strike pan, grained and masse cuite weighed, then centrifugalled and sugar and molasses weighed. The following are results—the analyses are from above:

Kind of Product.	Weight.	Sucrose.	Glucose.	Pr ct glu'se to su'se
Limed juice	640. lbs	76.80 lbs	6.91 lbs	9.00
Concentrated juice	198. lbs	76.42 lbs	7.44 lbs	9.73
Masse cuite	96. lbs	72.47 lbs	8.60 lbs	11.90
Sugar	55.50 lbs	52.78 lbs	.55 lbs	1.04
Molasses	50.25 lbs	19.69 lbs	8.12 lbs	41.30
Loss by the Yaryan	......	.38	....	.....
Loss by the pan	......	3.95	....	.....
Gain by Yaryan	......	.....	.53	.....
Gain by pan	......	.....	1.25	.....
Nett gain in in Yaryan	......	.....	.13	.....
Nett loss by pan from analyses	......	2.76	.....	.....

Analyses show that about 1½ lbs only of sucrose was inverted. The apparent nett loss probably did not exist. The goods were weighed in the sugar house on one-thousand-pound platform scales, while the laboratory analyses are based upon the most accurate weighings upon delicate balances. Again, though each vessel through which these products passed was carefully washed, some little was necessarily lost. It is also

very difficult to obtain a fair sample of molasses from a centrifugal in which water is used in purging the sugar.

This experiment shows conclusively that inversion is reduced to a minimum by such defecation.

The molasses from this experiment was mixed with that from experiments 22, 24, 27 and 29.

The raw juice contained........................... .43 per cent ash
The combined molasses contained................ 4.72 per cent ash
Containing—
Potash...45.13
Lime... 6.14
Phosphoric acid... 2.03
Sulphuric acid...10.47

EXPERIMENTS NOS 22, 24.

Manures used—Meal Phosphate with ½ and ⅗ rations of Carbonate of Potash.

Yield of cane—1106 lbs., yield of Bagasse 388 lbs.
Yield of juice—718 lbs., Extraction 65 per cent.

TREATMENT OF JUICES.

Solution of oak bark added to saturation; limed to slight alkalinity and made slightly acid with superphosphate of lime (home made).

LABORATORY ANALYSIS.

Kind of Product.	Degrees Baume.	Total Solids.	Sucrose.	Glucose.	Co-effi't Purity.	Glucose per cent Sucrose.
Raw juice No. 22	8.1	14.6	10.7	1.34	73.3	12.52
Raw juice No. 24	8.0	14.5	10.5	1.34	72.4	12.76
Tannic Acid juice (both)	7.5	13.6	10.0	1.30	73.5	13.00
Limed juice (both)	6.5	11.7	9.0	1.30	76.8	14.44
Concentrated juice (both)	23.	39.3	30.0	4.20	76.4	14.
Molasses (both)	36.	67.2	38.3	16.20	......	42.29
Sugar (both)	......	......	92.3	1.58	......	17.11
Skimmings (both)	3.5	6.3	4.9	.60	......	12.24
Settlings (both)	7.3	13.2	7.7	.96	......	12.46

SUGAR HOUSE RESULTS.

In the juice there were	76.28	lbs.	Sucrose	9.61	lbs.	Glucose
Removed in scums and settlings	10.65	"	"	1.31	"	"
Leaving	65.63	"	"	8.30	"	"
208 lbs. concentrated juice gave	62.40	"	"	8.74	"	"
86.5 lbs masse cuite	62.24	"	"	9.84	"	"
44. lbs. sugar	40.61	"	"	.69	"	"
56.5 lbs. molasses	21.63	"	"	9.15	"	"
Total accounted for	72.89	"	"	10.46	"	"
Add sucrose .8 lb. equal to Gain in glucose.	73.69					
Balance unaccounted for	2.59					

EXPERIMENTS NOS. 27, 29.

Manures used—Meal phosphate, with ⅓ and ⅔ rations of Nitrate of Potash.

Yield of cane—1270 lbs, Yield of Bagasse 490 lbs.

Yield of juice 780 lbs, Extraction 61.4 per cent.

TREATMENT OF JUICE.

Solution of Oak Bark to saturation, limed to slight alkalinity and made slightly acid with superphosphate of lime (home made).

LABORATORY ANALYSES.

Kind of Product.	Degree Baume.	Total Solids.	Sucrose.	Glucose.	Coefficient Purity.	Glucose per cent of Sucrose.
Raw juice No. 27	8.2	14.8	11.4	1.27	77.0	11.1
Raw juice No. 20	7.7	13.9	10.5	1.50	75.5	14.3
Tannic acid juice [both]	7.4	13.3	10.7	1.21	79.7	11.3
Limed juice [both]	7.2	13.0	10.8	1.41	83.0	13.0
Concentrated juice [both]	20.5	35.5	28.4	4.40	......	15.6
Molasses [both]	34.5	......	38.0	14.80	......	38.95
Sugar [both]	......	......	96.4	.72	......	.74
Scums [both]	......	......	6.7	.96	......	14.32
Settlings [both]	6.7	12.0	8.7	1.00	......	11.49

SUGAR HOUSE RESULTS.

In the raw juice from analyses	84.91	lbs	sucrose	and	10.92	lbs	glucose
Removed in settlings, etc	15.25	"	"	"	1.87	"	"
Left in limed juice	69.66	"	"	"	9.05	"	"
230 lbs concentrated syrup contained	65.32	"	"	"	10.12	"	"
66.5 lbs masse cuite contained	65.50	"	"	"	9.30	"	"
44 lbs sugar contained	42.42	"	"	"	.31	"	"
60¾ lbs molasses contained	23.08	"	"	"	8.99	"	"
Total recovered	80.75	"	"	"	11.17	"	"

Here the juice was made slightly acid and a slight inversion took place in concentrating the juice, but not enough to account for the loss, which is about 4 lbs. This discrepancy must be due to the manner of working, which was to weigh the cane and bagasse on a five-ton scale, and the difference between the weights was called the weight of juice.

The difficulties encountered in conducting the experiments just closed were very great. In the first place our cane and bagasse were weighed on a five ton scale, and the difference estimated as juice. While every precaution was taken to see that both were weighed promptly and in order, yet the losses and gains on our work where chemical analyses indicated good results, fluctuated between ½ to 5 lbs. to the experiment. It is believed that with a proper weighing of the juice, that more accurate results can be obtained. Again the taking of samples which was done after each operation of each experiment, was a task requiring much care and the exercise of much patience. It required much time to thoroughly mix either the molasses or sugar from each experiment. Too many instances occurred where products were not weighed, and samples not taken, which vitiated the calculations of our results, but they were due largely to the inexperience of all in this enterprise, and another year our familiarity with what is required will probably correct these errors.

The experiments clearly show that juices worked acid, will certainly invert sucrose, the amount depending upon the degree of acidity and duration of action and heat. They further show that neutral juices can be worked with little or no inversion of sugar. They also show, that there are necessarily no unknown losses in the manufacture of cane in Louisiana. The sugars, molasses and skimmings, should contain all the sugars started with in the juice either as such or transformed products. These experiments indicate further, the danger of the use of sulphur in clarification, as well as the success in our hands of oak bark. This latter however needs further investigation to study other questions not involved in these trials.

ASH ANALYSES.

All through the season, the ash of different juices was determined, and it may be assumed without much error that the mineral matter of all our cane juices amounts to about .50 per cent.

Excessive quantities of phosphoric acid and potash were

used in different forms as manures on Plats VII and VIII. An attempt was made to determine what effect heavy doses of these fertilizing ingredients would have on the juices of the cane and upon the masse cuites in restraining crystallizable sugar. These analyses varied greatly, as was to be expected from the different methods pursued in clarification. Again, many impurities existed in the molasses of this Station, since we had no filter press by which we could relieve the syrups of any sediment after concentration and hence to avoid loss and to make our experiments as accurate as possible, all sediments after clarification were carried forward into the molasses.

The analyses are appended :

ANALYSES OF ASH OF MOLASSES FROM CANE TREATED WITH DIFFERENT KINDS AND QUANTITIES OF MINERAL MANURES.

Ash in Raw Juice.	Ash in Molasses.	100 Parts of Ash of Molasses Contain							No. of Plat.	No. of Experiment.	Manures used.	Treatment of Juice.	Condition in which Worked.
		Potash.	Soda.	Lime.	Ferric and Aluminic Oxides.	Phosphoric Acid.	Sulphuric Acid.	Silica.					
.48	5.09	37.57	11.41	4.39	4.56	2.48	9.45	2.30	VII	2, 4 & 5	Cotton Meal, Kainite $\frac{1}{3}$, $\frac{2}{3}$ & 3-3 Bone Black	Sulphured & Limed in excess	Alkaline.
.44	3.59	36.00	7.32	2.81	4.91	2.58	11.94	2.25	VII	7, 9 & 10	Cotton Meal, Kainite $\frac{1}{3}$, $\frac{2}{3}$ 3-3 A'd Phosphate	Sulphured & Limed to neutrality	Neutral.
.58	......	34.84	5.20	3.91	6.02	2.60	10.34	2.00	VII	12, 14 & 15	Cot. Meal Kainite $\frac{1}{3}$, $\frac{2}{3}$ 3-3 Precip. Dis. Bone	Sulphured & Limed and left acid	Acid.
.50	......	36.54	3.86	1.76	5.68	7.19	10.74	1.82	VII	17, 19 & 20	Cot. Meal Kainite $\frac{1}{3}$, $\frac{2}{3}$ 3-3 Precip. Ac'd Phos.	Sulphured & Limed and left acid	Very slightly acid
.49	.....	39.50	3.03	3.66	7.32	4.00	8.36	2.00	VII	22, 24 & 25	Cot. Meal Kainite & $\frac{1}{3}$ $\frac{2}{3}$ & 3 3 Bone Dust.	Sulphured & Limed to nearly neutrality	Nearly Neutral.
....	4.76	36.55	......	7.87	4.72	3.62	9.81	5.87	VII	16, 21 & 26	Cot. Meal and Kainite.	Solution Oak Bark and Limed	Slightly Acid.
.47	3.85	42.30	.03	5.54	5.70	1.98	7.82	4.92	VII	18, 23 & 28	No Manure.	Solution Oak Bark L'd & Super. of Lime	Very slightly acid
....	4.76	36.00	7.09	5.52	11.17	3.62	7.91	7.82	VIII	7 & 9	Cot. Meal & Phos. $\frac{1}{3}$ & $\frac{2}{3}$ Mur. Potash.	Solution Oak Bark L'd & Super. of Lime	Very slightly acid
....	4.66	51.48	1.10	3.54	8.69	2.27	13.92	3.54	VIII	12 & 14	Cot. Meal and Phos. $\frac{1}{3}$ & $\frac{2}{3}$ Kainite.	Sulphur & Oak Bark and Limed	Slightly Alkaline.
.43	4.72	45.13	.84	6.14	2.01	2.03	10.47	3.60	VIII	17, 19, 22, 24 27 & 29	Cot. Meal & Phos and Sulphate, Carbonate & Nitrate Potash	Solution Oak Bark L'd & Super. of Lime	Slightly Alkaline.
.53	......	......	......	......	......	3.26	9.16	......	II	36, 37, 39 & 40	Stable manure with Phos. Acid & Kainite	Sulphur and Lime.	Neutral.
Av of all .49	4.49	39.59	4.43	4.51	6.07	3.24	9.99	3.61					

An inspection of this table will show that excessive doses of potash as manure have increased this ingredient in the juice, and since there is no known way of removing it, it passes into the molasses. By reducing the above analyses to a similar content of what are really accidental impurities, this becomes more apparent. It is therefore *probable* that *excessive quantities* of *potash* in manures are *detrimental* to the yield of sugar. Analyses of molasses do not show excesses of phosphoric acid in the juices, since this substance is removed by lime in defecation. The sulphuric acid is largest in the molasses where sulphur was used in defecation.

MASSE CUITE.

The exact quantity of water to be left in masse cuite, so that in the centrifugal it will purge itself—is a question of great importance. It is evidently a waste of fuel to over-cook the cuite and then use a large quantity of water to purge the crystals.

A series of analyses of masse cuites is herein inserted. They can hardly be compared with each other, since varying quantities of water were used in the centrifugal. The water used to 100 lbs. masse cuite, was not always on the sugar; indeed the greater part was wash water of the pan and centrifugal.

ANALYES OF MASSE CUITE.

No. of Experiment.	Sucrose.	Glucose.	Solids not Sugars.	Water.	Per cent of Sugar obtained.	Per cent of Sucros in Sugar.	P. c. pure Sucrose ob-t'd f'm masse cuite.	Per cent of Sucrose present.	lbs. of water used to 100 lbs. masse cuite.	REMARKS.
31	75.09	7.89	7.82	9.20	53.0	90.6	50.9	67.8	18.8	
33	73.47	12.00	6.00	9.00	51.5	96.1	49.5	67.4	7.0	Boiled thick to prevent foaming.
34	70.41	12.31	5.12	12.15	40.6	95.7	38.9	55.2	11.1	St'k thin & no water us'd in Fugal
35	76.17	11.42	6.00	6.41	49.4	97.1	47.0	61.7	11.3	Washed to obtain a good grain.
36	76.73	12.22	4.00	7.05	49.5	96.2	47.6	62.0	10.7	Washed to obtain a good grain.
2	76.75	10.00	4.45	8.80	55.5	96	53.3	69.4	9.0	Fugalled 6 hours after strike.
7	75.00	10.00	7.00	8.00	46.2	95.8	44.3	59.1	16.8	Hard coarse grain—well washed.
3	74.66	8.61	7.87	8.86	48.0	95.8	46.0	61.6	7.3	
12	72.70	11.77	6.00	9.53	42.9	92.2	39.6	53.1	11.5	
22	73.00	7.49	6.24	13.27	50.9	95.8	48.8	66.8	3.4	
27	75.80	9.84	5.74	8.62	55.1	92.4	50.9	67.1	9.8	
32	76.52	8.00	8.00	7.48	48.9	96.0	46.9	61.3	7.3	
16	77.84	6.44	7.83	7.89	57.6	95.8	55.2	70.9	6.1	Cut strike, ½ fugalled 3 hours after strike gave 62 per cent sugar.
18	75.68	9.21	6.93	8.18	53.9	97.0	52.3	69.2	2.2	Good even grain of good size.
7	76.53	11.63	3.38	8.46	56.5	95.8	54.1	70.7	3.8	
12	76.04	8.30	6.21	9.45	54.7	95.1	52.0	68.4	7.3	
17	75.50	9.05	8.85	6.60	57.8	95.1	55.0	72.8	11.6	
22	71.74	11.28	8.23	8.75	50.9	92.3	47.0	65.5	15.6	

Can one tell in advance what will be his return in sugar from his masse cuite? Nothing is more difficult. If this masse cuite was a mixture of pure sugar and water the task would be an easy one.

But unfortunately in practice our masse cuite contains an unknown quantity of different foreign matters—glucose and mineral salts—beside the sugar and water. It is known that all viscous and gummy matters, dextine, glycerine, gelatine, soluble albuminoids, including legumine, colloids of all kinds, restrain sucrose in the molasses. Glucose, by its viscosity also acts in a similar manner. The exact amount, restrained, is yet an unsolved problem. It is variously estimated from once to twice their entire weight. Sulphates and phosphates of potash and soda are regarded as inoffensive, *i. e.*, they do not decompose, alter or prevent crystallization. They simply increase the masse without decreasing the actual weight of sugar obtained. Chloride of calcium and other deliquescent salts are objectionable, because the water, which they absorb dissolves some of the sugar. Common salt and Chloride of Potassium

unite with sugar to form double deliquescent salts, destroying 4 to 6 parts of their own weight of sugar, while caustic Soda and Potash are actual destroyers of sugar by transforming it into lower products. With these facts before us, who can tell how much sugar the average masse cuite of Louisiana will yield? Working upon cane of different degsees of *immaturity*, and therefore of varying composition, by processes, almost peculiar to each sugar house who can tell the numerous changes which the juices, the most unstable of all vegetable products, have undergone in their concentration to masse cuite? Could perfectly matured uniform canes be grown and their juices subjected to identical treatment, then a thorough chemical examination of juices from the mill to the masse cuite once made might be always applicable. But these are impossibilities in Louisiana and hence we have to make empirical formulas for our work, which are often radically inappropriate and inexact. It usual in Louisiana to subtract the solids not sucrose from the sucrose and reckon the remainder as available. This is far from being true in practice. It is further asserted that cold water dissolves three times its own weight of sucrose. Apply any of these to our own results above and it will be found that we have greatly surpassed the theoretical yield. Indeed our yield in pure sugar is often greater than the supposed soluble influence of the water (alone) would permit.

In the beet sugar industry 10 per cent. is the usual amount of water left in the masse cuite. There the glucose is almost entirely absent. In Louisiana, however, it abounds largely in our masse cuite, forming a liquid menstrum in which sucrose can crystallize, therefore it has been found that water can be reduced to a much lower quantity with most excellent results. In fact there seems to be a co-ordinate relation between the glucose and water present. If glucose is large the water can be greatly reduced and *vice versa*. From our experiments, when the glucose attained about 9 to 10 per cent. (an average amount) the best results were obtained with from 6 to 7 per cent of water. With such a composition, the crystals purged themelves nicely, requiring the minimum amount of wash water and giving maximum results in sugar.

It was also found that a larger quantity, with better grain of sugar was obtained by permitting the masse cuite to cool from 3 to 4 hours; heated water exercising a higher solubilty over the sugar than when cooled to a lower temperature. An examination of the table above with that of the ash of the molasses will show that about ½ of the solids not sugars in the masse cuites are mineral salts, and these, if the juices have been properly treated, are innocuous. The remaining half may be classed with glucose in its inverting power.

When a juice has been treated by processes which give little or no inversion, the amount of these substances not sugars left in the masse cuites to restrain sucrose, will amount to about ½ of the glucose. Therefore in estimating the available sugar in raw juice, it is not far wrong to calculate by the following formula, viz: subtract from the sucrose, one and one-half the weight of glucose and call the remainder available.

JUICES FROM 2ND PRESSURE.

On December 10th, 792 lbs. bagasse which had already yielded 66 per cent juice was subjected to a second pressure. The rolls and the juice troughs were thoroughly cleansed before the pressure. The juice was carefully caught, weighed and analysed. The rolls and troughs well washed and washings weighed and analysed.

The bagasse caught on a large sheet, weighed 717 lbs.—showing a loss of 75 lbs.

Of pure juice there was collected..		31 lbs.
Of Washings....................		41 lbs.
The juice contained..............	13 per cent Total Solids	
	9.2 Sucrose	
	.82 Glucose.	
The Washing contained...........	.70 Sucrose, giving	
A total of Sucrose of.........	3.14 lbs.	

Or a total of about 34 lbs. pure juice—showing an unaccountable loss of about 40 lbs.

Another sample of 522 lbs. was taken and similarly treated with almost identical results—

Only here the juice showed	17.8 Total Solids.
	12.4 Sucrose.
	1.02 Glucose.

The juices from the 1st pressure were both richer in Sucrose.

What became of the lost 40 lbs? Was it water vaporized in the mill and before weighing of the finely divided bagasse? The iatter was weighed just as quickly as it could be handled, after grinding. Weather clear and dry. Maximum Temperature 65° F.

SECOND SUGARS.

Several attempts were made to make second sugars, but it was found that in the absence of a hot room, that good results could not be obtained. Again our little centrifugal purged with difficulty the crystals of 2d sugar. It was therefore determined to abandon further tests.

Th following were the results:

PLAT II—EXPERIMENT No. 1.

The molasses from 1st sugars were boiled to string—granulated after several days and centrifugalled. From these we have full results, as follows:

Experiment No. 1—

70 lbs. 1st Sugars @	90°2	63.14=	52.7	per cent
14.71 lbs. 2d Sugars @	85°	12.50=	10.5	" "
76.3 lbs. 2d Molasses @	35.3	26.92=	22.5	" "
117. lbs. Skimmings @		14.62=	12.2	" "
Loss		2.50=	2.1	" "
Total		119.68	100.0	" "

Total Sugars 63.2 per cent; 103 lbs. Sugar @ 90.2 to the Ton of Cane.

Experiment 3, gave by same treatment—

108 lbs. 1st Sugars	91°5	97.74=	60.7	per cent
26 lbs. 2d Sugars	83°	21.62=	13.8	" "
66 lbs. 2d Molasses	33.3	22.07=	13.9	" "
Skimmings and loss		18.21=	11.6	" "
		159.64	100.0	" "

Total 74.5 per cent; 122 lbs. @ 91.5 to the Ton of Cane.

Experiment No. 7, gave—

95 lbs. 1st Sugars @	87°6	83.16=	68.2	per cent
11¼ lbs. 2d Sugars @	83	9.30=	7.7	" "
51½ lbs. molasses @	33.5	17.26=	14.20	" "
85 lbs. Skimmings @	6.8	5.77=	4.7	" "
Inversion and loss		6.43=	5.2	" "
		121.92	100.00	" "

Total Sugars 75.90 per cent; 113 lbs. @ 87.6 to the Ton of Cane.

Experiment No. 6—

107 lbs. 1st Sugars @	96°	=103.00=	63.	per cent
26½ lbs. 2d Sugars @	83°	= 21.94=	13.4	" "
68 lbs. Molasses @	33.3	22.66=	13.8	" "
Skimmings and loss		15.99=	9.8	" "
		163.59	100.0	" "

Total Sugars 76.4 per cent; 117 lbs @ 96. to the Ton of Cane.

Experiment No. 13—

81 lbs. 1st Sugars @	96.	= 77.76=	53.4	per cent
25 lbs. 2nd Sugars	80.2	= 20.05=	13.8	" "
64 lbs. 2nd Molasses		27.07=	18.6	" "
130 lbs. Skimmings		12.09=	8.3	" "
Loss		8.60=	5.9	" "
		145.57	100.0	" "

Total Sugars 67.20 per cent; 94 lbs. @ 96. to the Ton of Cane.

LOSS IN SCUMS, SKIMMINGS AND SETTLINGS.

Few planters have even an approximate idea of the amount of sugar emptied into the ditches during the grinding season. In the first place, the blanket thrown away is usually equally as rich in sucrose as the juice from which it comes. The skimmings and brushings removed in concentration are much richer in sucrose than the juice. The settlings, both from the treatment with lime and from the syrup after concentration, are also rich in sucrose. In our work they are all grouped together and called "skimmings," unless otherwise mentioned. Numerous attempts were made to work these skimmings so as to recover every pound of sucrose possible. They were worked over in every conceivable way, repeating the operation as often as four times in many instances, and the lowest results obtained in sucrose, thrown away, was 4 per cent of the total amount in the juice worked. This often reached as high as 10 per cent, and where no care was taken to save them reached even 12 and 15 per cent of the sucrose present. This is an enormous loss in itself; but add to this the sucrose inverted in the process of refining these products and the loss will be even greater. The amount of this inversion depends upon the temperature of the sugar house and the delay in working them. But worked as soon as possible, and at any temperature, analyses will reveal

a greater glucose ratio and a lower purity co-efficient, which are positive declarations of inversion. The total loss from these sources, given by Mr. Spencer in Bulletin No. 15, Magnolia Experiments, at 6½ per cent derived from the results of his work, is regarded by him as far too low. This season's work fully substantiates the work of Magnolia, and we would say after all our trials, that the loss is certainly between 5 and 15 per cent of the juices worked. How can we avoid this loss? It has been demonstrated that

FILTER PRESSES

will greatly reduce it, and perhaps, by skillful use, nearly obliterate it. A Kroog Hand Filter Press—kindly furnished for a short time for experimental purposes by Mr. Shultze, of the Sangerhausen Works of Germany—was used to test this question in two instances. In the first, Experiment No. 32, three pounds pulverized charcoal were added to the skimmings and boiled for ten minutes and then filtered. With so small a press the operation was a lengthy and tedious one, and therefore inversion took place before the work could be finished. There was no way of steaming the cake formed, and hence the latter was not washed. At the end of the operation, however, there was found in the cake formed 2.29 lbs. sucrose from a total of 122 lbs. of the juice, or not quite 1.9 per cent. This, by proper steaming and washing, might have been reduced to at least 1 per cent.

Second trial was with Experiment No. 34. Here no filtering medium was used, but the mass of skimmings sent directly to the press. This operation was a more tedious one, and required oftener the removal of the filter cloths. The inversion was, however, not so great. Here we obtained 2.9 lbs. sucrose in the cake out of 120 lbs. sucrose in the juice, or 2.4 per cent. loss. The cake was not carried to anything like dryness, on account of the difficulty of the hand work. With steam power and steam in the press, the cake might have been made quite solid and sugar contents greatly reduced.

From the results of these experiments, there is no hesitancy in declaring filter presses as a crying necessity in the sugar houses of the State, to save the sugar now thrown away

in the ditches, if not for use in the adaptation of the WILLIAMSON & RUMMER'S or KLEEMAN'S processes in our work.

On the 10th of November the following experiments were made with what was then believed to be the Kleemans process of treating raw juices, but which has been subsequently shown to be Williamson & Rummer's:

No. 1.—60 gallons juice (*a*) received 150 pounds of lime and 100 c. c. superphosphate of alumina; without removal of the blanket, 9 lbs. pulverized German lignite were added, and the whole mass boiled for five minutes and then sent to Kroog's press. The filtered juice (*b*) was clear and limpid. In concentrating, a white scum arose to the surface, which had to be removed. It was concentrated to 25° B (*c*) in open pan. In cooling a precipitate formed, due mainly to the superphosphate of alumina added.

No. 2.—6 gallons of juice (*a*) was limed to neutrality and boiled ten minutes with 1½ lbs bituminous coal and filtered, which gave a clear but dark-colored juice (*b*).

No. 3.—5 gallons juice (*a*) was limed and left acid and boiled for five minutes with 1¼ lbs. pulverized bituminous coal and filtered, which gave a clear and limpid juice (*b*); concentrated to 22° B (*c*) in open pan, which remained clear on cooling.

ANALYSES OF ABOVE.

No. of Experiments.	Degree Baume.	Total Solids.	Sucrose.	Co-Efficient Purity.
1 *a*.	8.0	14.5	12 5	84.8
1 *b*.	7.6	13.7	13.0	94.9
1 *c*.	29.0	53.5	44.0	82.2
2 *a*.	8.0	14.5	12.5	84.8
2 *b*.	8.4	15.2	13.7	90.1
3 *a*.	8.0	14.5	12.5	84.8
3 *b*.	7.6	13.7	13.0	94.9
3 *c*.	27.0	49.7	41.7	83.9

2 (*b*) was concentrated a little in boiling.

The increased coefficients of purity indicated the removal of a large amount of solids not sugar. Our supply of pnre German Lignite gave out with one experiment, hence we could not tell anything about its decolorizing effect, which is claimed for it by Mr. Kleeman, and which is proposed as a substitute for Bone Black. The bituminous coal used here and pulverized

charcoal subsequently used, had apparently similar results, causing an easy filtration of the juice from the solids, but exercising little or no decolorizing effects.

The method is a rapid one, and quickly disposes of the otherwise troublesome scums and settlings. There is no skimming required, and on this account we think it a great improvement over the usual way of clarification. But it is well known, that a portion of the Albuminoids coagulable by heat and lime are rendered soluble by boiling with lime, and the appearance of scums in the subsequent concentration would indicate that these Albuminoids had not been successfully removed. Unfortunately at this time, our entire laboratory force was engaged in the regular work of the sugar house and therefore could not determine this question by analysis. But we find our suspicions corroborated by the experiments of Dr. Spencer, at Magnolia, Bulletin 15, page 24. who found only 35.17 per cent of the Albuminoids in the juice removed by this process, while 45 per cent. are removed by the ordinary way of clarification.

The Kleeman process, as we have since learned, varies from the above in two essential points. 1st. The juice is defecated as usual, and the clear juice and the scums with settlings, separately treated with brown coal. 2nd. The concentrated juice is again mixed with brown coal and filtered, the last operation being performed by gravity. The Station has recently received a beautiful Filter Press from Messrs. Pusey & Jones, of Wilmington, Delaware, through their courteous agents, Messrs. Kirchoff Bros., of New Orleans, and will, the coming season, experiment extensively in these processes, accompanying them with analytical work in the Laboratory. It is also receiving samples of Lignite from Louisiana, Alabama and Mississippi, for the purpose of finding if possible, a home article which can substitute brown coal.

In closing this the report of a series of experiments which involved a great expenditure of time and patient, careful labor the Director wishes to return his personal thanks to all persons who so kindly aided him in his work.

Special acknowledgements are made to my regular assistant Mr. W. L. Hutchinson, and my volunteer assistants, Messrs. J. P. Baldwin, Jr., and Wm. Shiel, of Louisiana, Mr. B. S. Burton, of Georgia, and Mr. J. D. Stubbs, of Virginia, for their arduous and intelligent labors, both in the sugar house and in the Laboratory, by which much of the success achieved, is due.

EVAN HALL SUGAR HOUSE.

Mr. Henry McCall, the enterprising proprietor of Evan Hall Plantation, has kindly placed at our disposal the record of his sugar house for the past season. This record was kept by Mr. Levin A. Becnel, chemist and machinist, who has used every precaution to insure accuracy. It is only deserved praise to say that Mr. McCall is one of our most intelligent and progressive planters, and his sugar house one of the best in the State.

This record, condensed, is presented in order to show the losses which are sustained even in our best sugar houses, and with the hope that proper appliances will be secured to avoid much of them in the future. It is learned that Mr. McCall has procured for the next season filter presses, whereby the losses in scums will be greatly reduced. It is hoped that similar records will be kept next year, so that by comparison the actual gains may be ascertained.

CONDENSED RECORD OF EVAN HALL SUGAR HOUSE, 1886.

No. acres cane ground..........	937		
" tons " "	22,368		
Av per centage of extraction....	75.85		
No. gallons juice extracted	3,846,000		
" pounds juice extracted......	33,933,564		
" " total solids in juice..	4,830,265		
" " sugar in juice......	3,614,700		
" " total solids in syrup..	4,103,632		
" " sugar in syrup......	3,121,719		
" " total solids removed in scums...........	726,633		
" " sugar rem'd in scums.	492,981		
" " masse cuite obtained.	4,837,049		
" " solids not sugar in masse cuite........	981,913	=20.30 per cent	Per cent composition of masse cuite.
" " sugar in masse cuite.	3,121,719	=64.54 per cent	
" " water in " " .	733,417	=15.16 per cent	
" " 1st sugars obtained..	2,440,678	=50.40 per cent of masse cuite	
" " 2nd " " ..	47,766		
" " all " " ..	2,488,444	=51.4 per cent of 1st masse cuite	
" " molasses from first masses cuite........	2,348,605		
" " water evapora'd from 1st molasses........	436,949		
" " wa'r left in mo's obt'd	296,468	=15.5 per cent	Per cent composition of molasses obtaind
" " su'r " " " ..	633,275	=33.1 per cent	
" " solids not sugar left..	981,913	=51.4 per cent	
" " Molasses obtained..	1,911,656		

Per cent of sugar obtained of total sugar in juice............	68.84 per cent
Per cent of sugar in molasses of total sugar in juice..........	17.52 per cent
Per cent of sugar lost in scums, etc...........................	13.64 per cent
	100.00

RECORD OF WEATHER LOUISIANA SUGAR EXPERIMENT STATION
MAY 1887.

Date. May.	Temperature. 9 A. M.	3 P. M.	9 P. M.	Maximum	Minimum.	Comparison of Wet Bulb.	Dry Bulb.	Daily Rainfall.	State of Weath'r	REMARKS.
1	76°	84°	80°	86°	70°	74°	76°	.00	Fair....	
2	77	84	89	85	69	75	77	.00	Fair....	
3	77	75	75	87	70	73	77	.00	Fair....	
4	65	74	78	75	63	65	65	.53	Fair....	
5	69	77	70	79	59	67	69	.00	Fair....	
6	75	83	76	84	61	73	75	.00	Cloudy.	
7	75	87	74	89	60	73	75	.00	Fair ...	
8	76	86	77	88	66	75	76	.00	Fair....	
9	80	88	79	90	63	78	80	.00	Fair....	
10	88	91	80	94	65	87	88	.00	Fair....	
11	76	88	79	90	70	75	76	.00	Fair....	
12	70	87	77	89	64	68	70	.00	Cloudy.	
13	74	84	80	92	64	73	74	.10	Cloudy.	
14	76	89	78	91	65	74	76	.00	Fair....	
15	74	87	73	90	64	73	74	.36	Cloudy.	
16	77	83	74	90	66	74	77	.00	Cloudy.	
17	70	87	71	89	66	68	70	.00	Cloudy.	
18	69	85	65	88	64	67	69	.00	Cloudy.	
19	70	83	71	86	59	69	70	.32	Cloudy.	
20	74	75	73	86	59	71	74	.00	Cloudy.	
21	76	87	74	89	62	75	76	.00	Fair ...	
22	73	89	73	90	65	70	73	.00	Fair ...	
23	72	87	70	89	63	72	72	.15	Fair ...	
24	73	91	74	92	67	71	73	.00	Fair ...	
25	70	90	68	91	66	69	70	.00	Fair ...	
26	76	87	73	90	64	74	76	.00	Fair ...	
27	74	89	70	89	61	70	74	.00	Fair ...	
28	74	90	71	90	63	73	74	.30	Cloudy.	
29	74	89	72	89	62	74	74	4.50	Rainy..	
30	71	86	67	87	60	69	71	.00	Cloudy.	
31	71	88	72	89	63	70	71	.30	Cloudy.	
Av.	74	86	75	89	64			6.56		

Highest temperature during month 94°.
Lowest temperature during month 59°.
Average temperature during month 77°.
Total rainfall during month 6.56.
Average daily rainfall .21.

OATS AND POTATOES.

BULLETIN No. 11

OF THE

STATE EXPERIMENT STATION

AND

SUGAR EXPERIMENT STATION.

Wm. C. Stubbs, Ph. D.,

—DIRECTOR—

—ISSUED BY—

THOMPSON J. BIRD,

COMMISSIONER OF AGRICULTURE, BATON ROUGE, LA.

BATON ROUGE:

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1887.

EXPERIMENTS IN OATS.

OBJECTS.

Are to test the economy of growing oats at home as a food crop for stock, in preference to the prevailing custom of importing annually large quantities at great cost. With these objects in view, efforts have been made to decide the following questions:

1st. Best time to sow?

2nd. Manurial requirements of our soils for growing oats?

A third question will next season be propounded—what variety is best for seed? This question forces itself upon us, since a large quantity of oats sold in our markets as "Rust Proof" are not true to name. The experiments of last year are repeated at both stations upon the same plats.

BEST TIME TO PLANT.

This year, sowings were made at the Sugar Experiment Station—on the last day of October, January 3rd and February 1st; on the State Experiment Station on October 30th, December 3rd and February 7th. The winter was very favorable to the growth of oats, and grave apprehensions were entertained for the safety of the fall oats, lest they might head before the winter was over and be killed, or that they would reach such a luxuriant growth as to "lodge" in the spring. The former were not realized—the latter occurred on a few of the most promising plats.

PREPARATION OF THE GROUND.

It was turned over in October with a two-horse plow, the oats and fertilizers sowed by hand, the former at the rate of two bushels per acre, and both harrowed in together. Good stands were everywhere obtained.

PREVIOUS CULTIVATION.

At the Sugar Experiment Station, as soon as the oat crop was removed last May, all the plats were sowed broadcast in cow peas. These were cut and made into forage in September, leaving only the root residues in the soil. At the State Experiment Station the plat in oats last year grew a good crop of crab grass, which was removed for hay. The other plats were culti-

vated in corn by tenants last year, and the ground, when taken for these experiments, was excessively foul with rank weeds, which required time and labor to eradicate.

EXPERIMENTS IN OATS.

SUGAR EXPERIMENT STATION, KENNER, LA.

PLAT NO. 12.

Land broken with two-horse plow; manures and oats sowed October 30th and harrowed in; harvested May 9th; weighed May 12th; threshed May 30th. The yields of last year are also given for comparison.

PLAT NO 12.

SUGAR EXPERIMENT STATION.

No. of Experiment.	Fertilizers.			Yield Per Acre			
				1886.		1887.	
	Kind.	Amt. Per Acre.	Cost Per Acre	W'ght of oats in sheaf.	Bushels of oats.	Wght of oats in sheaf.	Bushels of oats.
1	Cotton Seed Meal Acid Phosphate	270 lbs. 270 "	$4.86	6137 lbs	67¾	6418 lbs	53 30-32
2	Cotton Seed Meal Acid Phosphate Kainite	270 " 270 " 270 "	6.80	6673 "	73 21-32	7563 "	56 22-32
3	Cotton Seed Meal Acid Phosphate	360 " 180 "	4.86	5564 "	64 17-32	6000 "	58 10-32
4	Cotton Seed Meal Acid phosphate Kainite	360 " 180 " 270 "	6.80	6127 "	67 20-32	6509 "	48 17-32
5	Cotton Seed Meal Acid Phosphate	405 " 135 "	4.86	4991 "	55 3-32	4000 "	39 12-32
6	Cotton Seed Meal Acid Phosphate Kainite	405 " 135 " 270 "	6 80	5409 "	62 28-32	5454 "	49 12-32
7	Cotton Seed Meal	300 "	2.70	6095 "	59 20-32	6162 "	30 31-32
8	Acid Phosphate	150 "	1.35	5405 "	57 30-32	9189 "	59 2-32
9	Kainite	150 "	1.12	5041 "	57 6-32	7027 "	51 13-32
10	Nothing	——	......	5041 "	57	8378 "	40 20-32
11	Cotton Seed Meal Acid Phosphate	300 " 150 "	4.05	8135 "	103 6-32	6216 "	70 30-32
12	Cotton Seed Meal Acid Phosphate Kainite	300 " 150 " 150 "	5.17	5837 "	70 4-32	8163 "	60 14-32

Before discussing the above, two factors which greatly interfered with the results must be mentioned; 1st. The beneficial effects of the pea vines, grown after the crop was made last year. The vines were removed, but the root residues have been instrumental in modifying greatly the effect of the manures used. 2nd. A drouth of over five weeks duration, from March 20th till April 23rd, just at the time these oats were heading, and when rain was absolutely essential for perfect fruitification. This cause seriously modified results, as is shown by the heavy straw and small percentage of grain.

The pea vines gave increased growth to all, as is shown by the increased weight of all the Experiments except No. 5, (which was again troubled with defective drainage), and apparently rendered useless the large application of cotton seed meal, if we may judge from the results of 8, 9 and 10, where no meal was used. The effect of the phosphate is quite apparent in the increased yield of grain. Judging from these Experiments, we may again say that kainite has added nothing to the combination of acid phosphate and cotton seed meal. The influence of pea vines, both when taken off and turned under, is almost marvellous upon the subsequent crops. This has been demonstrated by experiments in cane, corn and oats. When turned under we should naturally expect good results, but largely increased yields are obtainable even when only the roots are left. Are these good results ascribable to the chemical food furnished by the decomposition of the roots alone, or to the accumulation of nitrogenous matter in the upper layers of the soil, brought about by the intense shade afforded the soil during the period of greatest nutrification? Have these numerous tap roots made the soil more open and porous, and left it better drained and in better tilth? What are all of the benefits which pea vines have upon subsequent crops? These questions we propose to investigate the following summer by weighing and analyzing both vines and roots, the latter dug up and washed out to the depth of two feet; at the same time accurately determining the amounts of nitrogen in pea-vined soil and that adjacent not pea-vined. In this way some light may be thrown upon this highly interesting subject.

Several of these plats, particularly No. 12, suffered badly from the rust, notwithstanding the seed used was of the Red Rust Proof variety. The drouth did the work.

In the above Experiments, Nos. 1, 2, 7 and 11 were so badly lodged that they had to be cut with sickles, hence their weights in the sheaf are below the others.

The following conclusions are suggested by these experiments: That pea-vined lands requires a diminished quantity of nitrogenous manures, but full rations of phosphoric acid, and that kainite is not yet needed on this kind of soil.

PLAT NO. 12 (*a*).

This plat was not in oats last year. Cane was windrowed for seed in it in the fall of 1885. It was pea-vined like No. 12 in May, and after that received the same treatment, except no manures were applied at the time of planting, October 30th.

On March 6th the manures were applied as a top dressing when the oats were a foot or more in height. Here are the results: Harvested May 12th, weighed May 16th, and threshed May 30th.

PLAT NO. 12 (*a*).

SUGAR EXPERIMENT STATION, KENNER, LA.

No. of Experiments.	Fertilizers.			Yield per acre.	
	Kind.	Amt pr acre.	Cost pr acre.	W't of oats in sheaf.	Bushels of oats.
1	Nitrate Soda.:	140 lbs	$3.85	5600 lbs	60 17-32
2	Nitrate Soda	140 "	5.11	5580 "	51 8-32
	Acid Phosphate	140 "			
3	Nothing	....	....	4070 "	34 27-32
4	Nitrate Soda	140 "	5.65	7230 "	45 6-32
	Acid Phosphate	140 "			
	Kainite	140 "			
5	Sulphate of Ammonia	150 "	4.50	5778 "	46
6	Sulphate of Ammonia	150 "	5.85	5890 "	44 11-32
	Acid Phosphate	150 "			
7	Nothing	....	....	4200 "	36 24-32
8	Sulphate of Ammonia	150 "	6.75	6510 "	62 1-32
	Acid Phosphate	150 "			
	Kainite	150 "			
9	Nothing	....	....	4588 "	28 21-32

The above manures were put out March 5th, and only one good rain occurred (March 20th) between its application and harvest. Hence results are uniform as regards straw, but very discordant in grain. In fact some of these experiments gave as low as 20 per cent of grain, due entirely to the effects of the drouth while heading.

PLAT NO. 13.

These experiments were sown January 3d, manures put on with oats, and harvested May 11th, weighed May 16th, and threshed June 12th. This plat was similarly manured last year. From Bulletin No. 4 we take the following:

OBJECT.

The object of these experiments was to test the value of ingredients used first on oats and then following with cow peas, to find what effect the residues of manures left in the soil would have on the latter. The late Dr. Ravenel, of Charleston, S. C., used a mixture of South Carolina floats (finely ground rock phosphate) mixed with kainite as a specific manure for cow peas. By its use an increased growth of peas was attained, which, turned under at the proper time, or permitted to rot on the surface, gave an enhanced fertility to the soil. Using these ingredients as sources of phosphoric acid and potash, alone and combined with cotton seed meal, and in another series substituting Orchilla phosphate (a natural deposit from the Caribbean Sea) for floats, we have tried to determine the effects upon these plats.

After harvest last year, this plat was sown in peas, the latter removed for forage and the land rebroken and sown in oats January 3d. The result of both years are appended.

PLAT NO. 13—OATS

SUGAR EXPERIMENT STATION, KENNER LA.

No. of Experiment.	Fertilizers. Kind.	Am't. Per Acre.	Cost Per Acre.	Yield Per Acre. Amount in Sheaved Oats. 1886.	1887.	Bushels in Oats. 1886.	1887.
1	Cotton Seed Meal Orchilla Phos. Kainite	250 lbs 250 " 125 "	$5.34	3860 lbs.	6278 lbs.	....	79 7-32
2	Cotton Seed Meal Floats Kainite	250 " 250 " 125 "	5.34	4776 "	6759 "	....	61 20-32
3	Orchilla Phos. Kainite	250 " 125 "	3.19	2520 "	5443 "	....	67 7-32
4	Floats Kainite	250 " 125 "	3.19	2580 "	5696 "	....	56 26 32
5	Orchilla Phosphate	250 "	2.25	2700 "	5696 "	....	72 14-32
6	Floats	250 "	2.25	2940 "	7346 "	....	64 3-32

These oats being much younger and smaller than Nos. 12 and 13, did not suffer as severely from the drouth. They were not so high as the fall oats, but were much better headed. The Orchilla seems to have given better results in gain than the Floats. Here again Kainite appears without effect. The Nitrogen does not seem to exercise so much influence as last year.

PLAT NO. 3—OATS.

This plat (in oats last year) was put in cow peas, vines removed and land plowed with a two-horse plow and manures and oats sowed February 1st. They started off well, but were soon checked by the prevailing drouth, developing the rust, which almost demolished it. It recovered slightly under the rains of May and came to harvest with poor yield June 3rd.

PLAT NO. 3—OATS.

SUGAR EXPERIMENT STATION, KENNER, LA.

No. of Experiments.	Fertilizers. Kind.	Fertilizers. Amount per acre.	Fertilizers. Cost pr acre.	Yield per acre. W't oats in sheaf 1886	Yield per acre. W't oats in sheaf 1887	Yield per acre. Bushels 1887
1	Cotton Seed Meal...............	480 lbs	$4.32	5686 lbs	1988 "	15 17-32
2	Nothing.........................	....	....	....	1095 "	8 18-32
3	Cotton Seed Meal............	480 "	5.18	....	1345 "	10 16-32
	Acic Phosphate..............	96 "				
4	Acid Phosphate..............	96 "	2.30	2594 "	960 "	9 10-32
	Kainite.....................	192 "				
5	Nothing.........................	....	....	2834	860 "	6 17-32
6	Cotton Seed Meal............	480 "	5.76	4890 "	1422 "	14 14-32
	Kainite.....................	192 "				
7	Acid Phosphate.................	96 "	.86	3295 "	1056 "	10 6-32
8	Nothing.........................	....	....	2353 "	768 "	5 7-32
9	Kainite.........................	192 "	1.44	2305 "	576 "	4 28-32
10	Cotton Seed Meal............	480 "	6.62	2883 "	1345 "	13 2-32
	Acid Phosphate..............	96 "				
	Kainite.....................	192 "				
11	Nothing.........................	....	....	2449 "	461 "	3 16-32
12	Cotton Seed Meal............	480 "	6.62	3170 "	1056 "	9 2-32
	Floats......................	96 "				
	Kainite.....................	192 "				

No comment is needed except to say that the entire plat was a most prodigious failure. It was planted February Ist, and during this month there were six rains on six consecutive days, from 17th to 21nd, giving 5.23 inches. On March 1st .it was quite vigorous and promising. It rained on the 7th and 20th of March, and from the latter date not a drop fell till April 23d, when there was a good shower, too late to repair the great injury done. After this no rain fell till May.

It was harvested June 3d, weighed June 14th, and threshed June 21st.

Experiments in Oats at State Experiment Station, Baton Rouge, La.

PLAT NO. 1—OATS.

This plat was in oats last year. After the oats were removed it grew up in crab grass which was cut and made into hay. It was plowed with a two horse plow October 29th, 1886, and manures and oats sown and harrowed in on October 30th. Harvested May 10th, 1887.

PLAT NO. 1 OATS.

STATE EXPERIMENT STATION, BATON ROUGE, LA.

No. of Experiment.	Fertilizers.			Yield Per Acre.			
	Kind.	Am't. Per Acre.	Cost Per Acre.	Weight in Sheaf.		Bushels Per Acre	
				1886.	1887.	1836.	1887.
1	Cotton Seed Meal	300 lbs.	$2.70	2280 lbs.	3167 lbs.	27 5-32	36.
2	Cotton Seed Meal Acid Phosphate	300 " 150 "	4.05	2700 "	3822 "	35 29-32	44.3
3	Cotton Seed Meal Acid Phosphate Kainite	300 " 150 " 150 "	5.17	3000 "	3567 "	41 5-32	39.3
4	Acid Pnosphate Kainite	150 " 150 "	2.45	2820 "	2427 "	38 5-32	24.7
5	Cotton Seed Meal Kainite	350 " 175 "	4.46	2553 "	2496 "	30 16-32	28.56

Here the mixture of acid phosphate and cotton seed meal has given the best results.

PLAT NO. 2—OATS.

This plat was in oats last year. The crab grass which grew on it after the removal of the oats was made into hay. It was broken by a two-horse plow and oats sowed and harrowed in on October 30th. On March 15th manures were applied as a top dressing to the growing oats.

PLAT NO. 2—OATS.

STATE EXPERIMENT STATION, BATON ROUGE, LA.

No. of Experiments.	Fertilizers.			Yield per acre.			
	Kind.	Amount per acre.	Cost pr acre	Weight in sheaf.		Bushels.	
				1886	1887	1886	1887
1	Nitrate of Soda.......	200 lbs	$5.50	3853 lbs	4900 lbs	43 20.32	....
2	Sulphate of Ammonia.	150 "	4.50	3713 "	3750 "	42 19.32	43 4-32
3	Nitrate of Soda..... } Acid Phosphate..... }	200 " 200 "	7.30	4213 "	4550 "	42 25.32	41
4	Nothing...............	....	....	863 "	2000 "	14 19.32	21 31-32
5	Sul. of Ammonia.... } Acid Phosphate..... }	150 " 200 "	6.30	3638 "	3900 "	41 6.32	43 16-32
6	Nitrate of Soda..... } Acid Phosphate..... } Muriate Potash .... }	200 " 200 " 100 "	8.80	4648 "	4450 "	49 26.32	56 21-32
7	Sul. of Ammonia.... } Acid Phosphate..... } Muriatic Potash.... }	150 " 200 " 100 "	7.80	4645 "	3900 "	48 15.32	45 3-32

Highest yield in 1886.....................................49.8 bushels
Highest yield in 1887.....................................56.7 bushels

Last year this plat was sown in the spring, this year in the fall, and hence results should have been much better, but the drouth already alluded to seriously vitiated the yield.

PLAT NO. 3—OATS.

As soon as the Lonisiana State University and A. & M. College came in possession of the U. S. Garrison with its lands, arrangements were at once begun to transfer the Station with the College. A piece of land of about seven acres, which had just grown a crop of corn and which had been left very foul with weeds, was selected for sowing in oats. After much labor in removing the weeds, it was broken with a two horse plow and divided into two parts. One was seeded to oats on December 3d, the other February 7th. On both the same fertilizer was used, which consisted of 200 lbs. Cotton Seed Meal and 150 lbs. Acid Phosphate per acre, put in with the seed, and both harrowed in.

That planted December 3d was harvested May 17th to 20th, and gave in sheafed oats 5122 lbs. and threshed 59.2 bushels per acre.

That planted February 7th gave 2250 lbs., and threshed 6.5 bushels per acre.

Both were injured by the drouth, but the latter most seriously, producing rust badly.

In all of our experiments the "Red Rust Proof" variety of oats were used at the rate of two bushels per acre. But none of these oats proved true to name, since they all, more or less, during the drouth, succumbed to the rust, which in several instances seriously injured the crop. This suggests the propriety of paying more attention to seed, and buying only such as are guaranteed to be "Rust Proof" and not of the variety of "Rust Proof."

CONCLUSIONS.

It is rarely wise to draw conclusions from the results of two years only, but when we consider the peculiar and almost opposite conditions which prevailed in these years, we think we can safely assert that oats in sufficient quantities to supply all our wants can be economically grown in Louisiana.

The winter of 1885-6 was very cold, destroying all winter sown grain—with an unusually wet spring. The winter of '86-87 was a peculiarly dry and open one, with an excessively dry spring. Yet in both years very fair crops of oats were made from *fall* sowings

The average of fall sowings at Kenner for 1886 was....65.4 bushels per acre
" " " " " " " " 1887 was....52.6 bushels per acre
" " " spring " " Baton Rouge for 1886 was.38.1 bushels per acre
" " " fall " " " " 1887 was.38.6 bushels per acre
" " " Dec. " " " " " 1887 was.59.2 bushels per acre
" " " Jan. " " Kenner for 1887 was.....66.2 bushels per acre

The February averages of 1887 are not made, since these were failures. Again, it has been shown by numerous planters from Baton Rouge to the Gulf during this season, that excellent crops of oats can be cheaply made by proper preparation of land and judicious manuring.

It is therefore with no hesitation that we recommend our planters to grow their own oats. Prepare the land well, sow in

October two bushels per acre of genuine "Red Rust Proof" oats, scatter broadcast with the oats four hundred and fifty pounds of a mixture of two parts of cotton seed meal and one part of acid phosphate, harrow them both in and open well your drains. In the spring you may confidently expect an excellent yield. If this crop be gathered by a reaper, or better a self-binder, the time and expense of harvest will be small. As soon as the oats are removed sow the lands in solid peas and it will be in excellent order for the fall planting of cane, or for a spring crop of cotton or corn.

POTATOES.

(Solarium Tuberosum)

The immense increase in the growth of trucks for market in the last few years in this State, particularly around New Orleans and Baton Rouge, has been very gratifying to the agriculturalists of the State. It inaugurates a new era in our agricultural industry. It is a harbinger of that bright future and exalted prosperity, which nature has decreed by her multiple gifts of soil, climate and geographical position, should be the legitimate destiny of Louisiana. With a climate permitting the growth of the greatest variety of crops, with soils of unparallelled fertility, with a great natural artery of trade connecting us on the one hand with the populous West and Northwest, and on the other by the gulf and ocean with the seaports of the world. With competing railroads reaching their iron arms from every progressive city in the land in search of our trade, nothing is wanting to make our State great and prosperous, but intelligent and well applied labor in the production of the largest and most diversified crops. The danger of over production is completely subordinated by the magnitude and easy accessibility of our markets. This gradual development of a new industry brings with it another blessing scarcely inferior to the physical and natural ones just mentioned. The truck grower, unlike the planter, is daily placed in keen competition with the world and must tax his most latent powers of observation and thought to reach the most expeditious and economical methods of producing the largest crops and placing them in the best and

cheapest conditions in the markets of the world. All this demands study, investigation, a more thorough and intimate knowledge of nature and her laws, a larger intelligence of his business, and a general mental development. It means small well tilled farms, closely crowded, bringing with them a higher social development in the multiplication of schools, churches, etc., giving to each individual farmer a pride of and love for country and State heretofore unknown.

The State Experiment Station realizing the importance of this industry to the State, began its efforts in its behalf this season. In reviewing the crops grown for the Northern markets, it was found that potatoes, onions and cabbages, were those which had received the largest attention. This was to be expected since the raising of these crops, together with melons, peas, tomatoes, etc., constitute what are termed "farm gardening," in contradistinction to true market gardening, and the former is always a prelude to the latter. The former may be adjunct to every farm, while to raise the latter successfully, a considerable expenditure of money and some practical experience are needed in the business in the purchase of sashes for hotbeds and cold frames.

The potato was selected as deserving our first attention.

The potato belongs to a family of plants which are noted for furnishing a very deadly poison: *Solarium*—The nightshade is a well known member of it. This poisonous principle is found in the potato only in very small quantities in the sap, berries and sprouted tubers. Cooking the latter, however, destroys this compound. This plant is a native of America, and is now found growing wild in the elevated portions of Arizona and Mexico. The tubers of the potato are not roots, but underground enlarged stems, with true buds (eyes) more closely crowded at the extremity (seed end) furthest from the plant, just as on an ordinary branch of a tree. The other extremity of the potato is called the stem end. These eyes are independent of each other, and develop and grow at the expense of the starch in the tuber.

The following directions have been taken from "Truck Farming in the South," a book published by Orange Judd &

Co., New York, and written by Dr. A. Oemler, of Savannah, Ga., the president of the "Chatham County (Ga.) Fruit and Vegetable Growers' Association," and who has been for over twenty years a successful Southern truck grower. His directions are therefore based upon practical experience and can be implicitly followed without fear of failure. His work (costing only $1 50) should be in the hands of every farmer and gardener.

VARIETIES TO PLANT IN THE SOUTH.

That variety which is productive of large and even-sized tubers, with few or no small ones, and early and popular enough in Northern markets to command high prices, is the one best adapted to our wants. The "Early Rose" meets these requirements, and is the general favorite, but the "Beauty of Hebron" and the "Burbank" are also grown. In Louisiana the Peerless seems to be the variety mostly grown, though it is far from being among the earliest to mature.

SIZE OF SEED FOR PLANTING.

Experiments have failed to decide the mooted question, whether it is more advisable to plant the whole potato, or to cut it up in sets. As a rule, cut large potatoes into single eyes; with small ones, divide into parts sufficiently large to furnish nutriment to the young sprout. To attain a crop with as many large potatoes as possible only one stalk should grow to a hill; three or more are apt to grow where whole potatoes are used as seed. Full maturity is more desirable than size of the cut. Over ripe potatoes often rot in the hill, and hence the largest potatoes are not to be preferred for seed. Medium size potatoes cut to single eyes, provided the latter are well developed, are the safest to plant. Northern raised potatoes sprout on reaching a Southern climate, and should not be imported until ready for use. After the first sprouts are rubbed off the succeeding ones will be weaker and more numerous. If the potato has not sprouted, there is less danger of more than one eye pushing up, if planted whole. Southern truck growers have found that the home grown seed of the second crop, maturing late in the fall, whether

cut or not, gives the best results. They are not so dry, and put forth only single shoots.

SOIL AND CULTIVATION.

In open, sandy, warm soil, plant as soon as cut; in cool, moist, heavy soil, dry by spreading the sets in the shade a day or two, or sprinkle with lime or plaster. The quantity for an acre is three to four barrels. Though a native of the South, it is found at high altitudes, and therefore its peculiarities adapt it more to the North than the South. It is intolerant of heat and drouth, and therefore should be planted as early as possible to escape warm weather. About February 1st is the best time to plant the earliest varieties. The potato requires a cool, moist soil, therefore black moulds, if well drained, will give enormous yields.

But the quality, which varies greatly with soils, will be inferior. The best quality of potato is grown on a sandy soil, but for yield a sandy loam filled with vegetable matter is indispensable.

The land should be thoroughly broken, well pulverized and highly manured. Stable manure is relied on for the potato grower. In its absence composts of cotton seed leaf mould and acid phosphate are to be recommended, using both in heavy quantities, remembering that land cannot be made too rich for potatoes. Generally dry manures should not come in contact with the sets lest the heat should destroy their vitality. Kainite should never be used on the potato or in the drill at the time of planting, for fear its deliquescent magnesium chloride will injure the stand. It should be broadcasted at least two months before planting. A yield of ten barrels from a single pound of seed, dividing single eyes into ten pieces, reported to a New York house, shows the effect of heavy manuring and the availability of very small eyes. Mr. Knight, a celebrated English Horticulturist and President of the Royal Horticultural Socitty, once made twelve hundred and eighty-four bushels of sixty pounds each, per acre. However, sixty to one hundred barrels per acre is quite a satisfactory crop for a Southern truck farmer.

They are usually planted in drills three or more feet apart,

and the sets (cut side down). placed at intervals of twelve or fifteen inches. In very light soil these sets may be covered six inches deep by the plow, and no hilling up in subsequent cultivation. In heavy soil cover to depth of three to four inches, and early in the growth draw up another inch or two; all after workings should be superficial. The crop should not be worked after the plant begins to bloom or to set the tuber.

HARVESTING THE CROP.

When the plant dies and not before, the crop should be gathered. Side the rows with the plow and remove the potatoes with a steel prolonged fork. Assort at once into first quality and culls. Dig the crop in cloudy weather if possible. If dug in sunshine, empty at once into well ventilated barrels and haul immediately to the shade or cover with vines. Potatoes will not endure exposure to the sun. Handle carefully and avoid bruising. When bruised add to the culls, shake well the barrel, press the head upon its contents and cooper strongly.

SECOND CROP.

The culls from the ripest field may be used for seed of second crop, and should be stored in a cool, dry place. They may be covered with very dry sand or put away in crates. Just before planting, if exposed for a day or two to warmth and moisture, sprouting may be hastened and a better stand secured. The time for planting the second crop is about August 1st. If the eyes have sprouted, the tubers should be cut, otherwise planted whole. Deep and thorough pulverization, with heavy manuring is more essential to second crop than the first in order to obtain maturity before frost. The seed from this crop can be used to plant in the spring.

EXPERIMENTS IN POTATOES.

Made at the Station were of two kinds.

1st. To determine the variety best adapted to this climate, soil and markets.

2nd. To determine the fertilizer best suited to a large and early growth of potatoes.

FIRST—VARIETIES.

Only five varieties could be obtained in Baton Rouge. These were secured and planted.

1st—Peerless—A large yellow potato, smooth, medium maturity, with large vines; a good bearer.

2d—Canada Victor—A large red, smooth potato, of good quality, small vines, little earlier than No. 1.

3rd—Burbank—Good size, round smooth potato, slight pinkish tinge, with distinct pink eyes. An early variety of great promise.

4th—Early Rose—Remarkably early; potatoes large, but not numerous; slight rose tint.

5th—Jackson White—Old variety; very productive; color white; shape oblong; not very early.

These varieties were planted February 2nd in connection with different fertilizers—the fertilizers running North and South and the varieties East and West. The fertilizers were put in the drill, a scooter run through them, and potatoes cut to two eyes, dropped at intervals of 12 inches and covered with the plow.

EXPERIMENTS IN VARIETIES AND FERTILIZERS.

No.	Fertilizers used per acre. 1	2	3	4	5	6	7	Average of all manures in bushels.
Varieti's used	1000 lbs cotton seed meal.	500 lbs Acid Phosphate.	500 lbs Kainite.	500 lbs kainite and 500 lbs Acid Phos'te.	1000 lbs cotton seed meal 500 lbs kainite	1000 lbs cotton seed meal 500 acid phos.	1000 lbs cotton sd meal, 500 lbs acid phosph'te 500 lbs kainite	
Peerless......	96.5 bu	53.5 bu	53.5 bu	38.3 bu	30.0 bu	103.3 bu	100.3 bu	67.9
Canada Victor...	100.0 bu	25.0 bu	38.3 bu	40.0 bu	43.3 bu	106.6 bu	110.0 bu	66.2
Burbank	86.6 bu	45.0 bu	38.3 bu	70.0 bu	60.3 bu	103.3 bu	120.0 bu	74.7
Early Rose..	83.3 bu	33.3 bu	16.6 bu	43.3 bu	36.6 bu	43.3 bu	100 0 bu	44.7
Jackson White...	106.6 bu	60.0 bu	30.0 bu	76.6 bu	70.0 bu	76.6 bu	135 0 bu	79.2

The above were dug April 19th, when the Early Rose was ripe—the Burbank nearly matured—the Canada Victor next, with the Peerless and Jackson White quite green.

SECOND—FERTILIZERS.

Grounds prepared in beds 3½ feet wide, opened, fertilizers deposited in the drill, mixed by running a scooter through them, potatoes cut to two eyes, and dropped 12 inches apart, and covered with a plow. Planted February 1st, and harvested April 19th. Variety used, Peerless.

EXPERIMENTS IN FERTILIZERS.

No. of Exp't.	1	2	3	4	5	6	7	8	9	10	11
Manures Used Per Acre.	Nothing.	1000 lbs. Cotton Seed Meal.	500 lbs. Acid Phosphate.	500 lbs. Kainite.	1000 lbs. Cotton Seed Meal 500 lbs. Kainite.	500 lbs. Acid Phosphate 500 lbs. Kainite.	1000 lbs. Cotton Seed Meal 500 lbs. Acid Phosphate.	1000 lbs. Cotton Seed Meal 500 lbs Acid Phos. 500 lbs. Kainite.	1000 lbs. Tankage.	500 lbs. Dried Blood.	Nothing.
Yield per acre in bushels in merchantible potatoes.	70.6	101.6	76.3	56.6	129.	88.6	141.	90.	132.	78.6	106.6
Yield per acre in bushels of small potatoes	16.6	20.	12.6	4.7	11.3	11.7	16.3	7.6	10.3	14.6	8.
Total yield per acre in bush.	87.2	121.6	88.9	61.3	140.3	100.3	157.3	97.6	142.3	93.2	114.6

REMARKS ON ABOVE.

The soil upon which the above was planted was a brown loam, whose previous culture had been of an execrable character It was prepared as best we could, but was far from being in excellent order. Except those plats in which Kainite was used excellent stands were obtained. The Kainite injured greatly the germination of the potato by abstracting from it the water and leaving the setts a dry honey combed mass of blackened matter. Hence the caution already given of never using this salt on potatoes at planting, but on the land, broadcasted, at least two months before. These experiments were planted Feb. 2d, and harvested April 19th. They started off well, were hoed and plowed Feb. 25th and March 18th. After that time a drouth of

unusual duration set in, which caused the vines to turn yellow and droop. The potatoes never reached full maturity and did not make anything like the yields they would have done with fair seasons.

It is difficult, therefore, to draw from these experiments any accurate conclusions. However, it seems that a mixture of cotton seed meal and acid phosphate has produced the best results, followed by tankage, which is a mixture of blood and bone (nitrogen and phosphoric acid). Dried blood forming only nitrogen, has not given as high results as cotton seed meal, which has also a small amount of phosphoric acid, and this in time is aided in its productive capacity by the addition of acid phosphate. The injury to the stand wherever kainite was used, leaves it still an open question whether potash is needed for fertilizers for potatoes.

VARIETIES.

The Early Rose was the earliest variety planted. The tubers were of fair size, very smooth, with very few small ones. The yield was, however, small—a great objection. The quality of this potato is excellent, and its appreciation is shown by its commanding, during the past season, at least 50 cents per barrel more than the white varieties. It would seem advisable to let this variety form a portion of the crop for very early shipment.

The Burbank was next to the Early Rose in maturity and in quality, with greater producing capacity. It has many qualities recommending it to the Southern truck grower.

The Canada Victor is a fine potato in size and quality, medium in maturity and very objectionable in color—very red.

The Jackson White gave us a large number of tubers, with very few large ones—due, probably, to immaturity when gathered; it is too late for early marketing; quality good.

The Peerless is a large producer, growing a great quantity of very large tubers, medium in maturity and very poor quality. It is an excellent variety for late shipments.

SHIPMENTS.

Ordinarily, the first shipments of fully ripe potatoes command the highest prices; accordingly, this year, as soon as it

was discovered that the drouth had prematurely suspended the growth of our crop, it was gathered and shipped. Subsequently it was found out that this year was an exception to the usual rule, for potatoes continued to advance in value until the crop was exhausted, and even now are commanding excellent prices. On the day that we dug, the local market in Baton Rouge quoted potatoes dull at $1 25 per barrel. We therefore determined to ship to the various markets. Thirty barrels were packed carefully and shipped, ten each to Cincinnati, St. Louis and Kansas City. Those consigned to the last place were shipped by rail over the Mississippi Valley road—the others by steamboat. All reached their destination without injury.

The freight, commission, etc., per barrel by steamer to Cincinnati was.	53
" " " and insurance per bbl by steamer to St. Louis.	48
" " " etc., per bbl by rail to Kansas City was......	$1 17
The potatoes sold in Cincinnati at...........................	$2.50 per bbl
" " " " St. Louis at................................	2.31 " "
" " " " Kansas City at...........................	2.85 " "
" " netted in Cincinnati................................	1.97 " "
" " " " St. Louis.................................	1.83 " "
" " " " Kansas City..............................	1.68 " "

The plat in potatoes raised at the rate of 30 barrels per acre—a very small yield, owing, as before stated, to the drouth.

The seed, 4 barrels per acre, cost........................	$ 9.00
The fertilizers used (on a part) cost....................	7.43
Total cost for seed and fertilizers...................	$16.43
The thirty barrels sold, nett.............................	54.80
Leaving for labor, barrels and profit, per acre...........	$28.37

The cost of preparing, planting, cultivating and harvesting a crop of potatoes will depend greatly upon the character of land and price of labor. It should not exceed $15, and can be reduced to $10. The seed (4 barrels to the acre) will cost usually from $2 to $2 50 per barrel. The manures, using 1000 lbs cotton seed meal and 400 lbs acid phosphate per acre, will cost about $14. The yield should not be less, with this manure, than 50 barrels per acre, and if the land is rich in vegetable matter even more. Adding the costs together, we have:

Seed	$ 8.00	to	10.00
Labor	10.00	to	15.00
Fertilizers	14.00	to	14.00
Total cost	$32.00	to	$39.00

Should 50 barrels be raised to the acre, the cost will then be 64 to 78 cents per barrel, and the profits realized per acre will be

$11.00 to $16.00	when potatoes sell for	$1.00	per barrel
22.00 to 32.00	when potatoes sell for	2.00	per barrel

The potato crop is taken off early enough to permit a growth of a second crop, with the soil in excellent condition from the cultivation received by the potatoes. On the Station a fine crop of cotton is now growing on the land from which the potatoes were taken in April.

I learn from Hon. Theodore S. Wilkinson that he has grown early potatoes for market this year between his rows of cane without any detriment to the latter. When pea vines have been turned under for the planting of cane, and rows seven feet wide, this practice promises success, especially if the potatoes be properly and heavily manured. The residue left by the potatoes, and the cultivation given the potatoes, would both be highly beneficial to the cane in its after growth.

CONCLUSIONS.

With the abundance of stable manure to be found on every plantation and to be had from the stables of New Orleans for almost nothing, together with the ease and cheapness that we can grow pea vines, there is no reason why our soils cannot be converted into the finest garden loams, upon which, with the aid of proper commercial fertilizers, maximum crops of potatoes can be grown. Stable manure is used by truck growers in large quantities—often as high as 100 tons per acre. It should be held in higher esteem by our gardeners. It is useless to attempt to grow large crops upon poor soils, or upon soils badly prepared or cultivated, or even upon soils improperly manured. One acre of potatoes upon a rich, well drained soil, properly

manured and judiciously worked, always brings more profit than many acres upon poor, unmanured soils, badly cultivated. Therefore, every one desirous of growing trucks, especially potatoes, should apply whatever home manures that is obtainable, turn under a good coat of pea vines, and supplement them both liberally with cotton seed meal and acid phosphate. Lands for successful truck growing must be many times richer than ordinary farming or plantation soils. With rich lands, well selected seed, good cultivation and careful preparation for market, handsome profits are always to be expected in Louisiana from truck growing.

Attention is called to the following letter from Mr. J. McQuade, one of a large number of planters who was induced to try the cultivation of oats, from the results obtained by the Station in '86 and published in Bulletin No. 4. He used the formula therein recommended.

PARISH OF EAST BATON ROUGE, LA., July 1887.

Prof. Wm. C. Stubbs, Director:

Dear Sir—On Nov. 24th, 1886, I sowed 30 acres of very thin land in oats. It was in 1885 in stubble cane which was killed by the freeze in January. Late in the spring the land was broken and planted in corn, which was very badly cultivated. I put according to your recommendations, four hundred pounds per acre of two parts of Cotton Seed Meal and one part of Acid Phosphate. I harvested 8000 lbs. of sheaved oats per acre, which gave when threshed 66 per cent. of grain or about 62 bushels per acre. I left several spots upon which I put no fertilizer and got no oats. I did not even cut them. I have sold Mr. Wm. Garig, of Baton Rouge, a lot of these oats and he estimates a saving from their use of at least three dollars per week, with seven head of stock.

Yours truly,

J. MC'QUADE.

RECORD OF WEATHER LOUISIANA SUGAR EXPERIMENT STATION, FOR JUNE 1887.

Date.	TEMPERATURE.					Rainfall.
June.	9 A. M.	3 P. M.	9 P. M.	Maximum.	Minimum.	Inches.
1	87°	93°	85°	93°	69°	
2	89	83	84	94	70	
3	89	90	88	94	70	
4	86	90	80	94	72	
5	84	89	77	90	70	
6	81	87	80	89	68	
7	84	90	84	91	69	
8	81	93	79	94	70	1.63
9	80	90	82	93	69	.40
10	79	89	79	91	67	
11	74	88	79	90	65	.50
12	74	87	72	90	65	
13	78	87	69	89	62	
14	78	88	76	88	62	
15	83	90	80	90	64	
16	84	89	80	91	69	
17	75	87	76	89	69	
18	74	89	77	89	70	
19	79	90	79	93	69	
20	73	87	71	89	71	.95
21	75	77	76	79	70	1.79
22	82	87	80	88	70	
23	83	89	83	90	70	
24	80	88	82	91	71	
25	84	93	81	94	72	
26	83	91	82	93	70	
27	80	82	75	83	70	1.50
28	75	80	72	80	70	1.55
29	79	85	72	88	68	1.36
30	78	75	73	78	71	.67
Average.	83.8	90.7	78.3			10.35

Maximum temperature 94°
Minimum temperature 62°

Total rainfall for month 10.35 inches.
Average daily rainfall .3:45

SORGHUM.

BULLETIN No. 12.

OF THE

LOUISIANA SUGAR EXPERIMENT STATION

Wm. C. Stubbs, Ph. D.,

—DIRECTOR—

KENNER, LA., JANUARY, 1888.

—ISSUED BY—

THOMPSON J. BIRD.

COMMISSIONER OF AGRICULTURE, BATON ROUGE, LA.

BATON ROUGE:

PRINTED BY LEON JASTREMSKI, STATE PRINTER,

1888.

SUGAR EXPERIMENT STATION,
Kenner, La.

Major T. J. Bird, Commissioner of Agriculture, Baton Rouge, La.:

Dear Sir—I hand you herewith a Bulletin on Sorghum, giving results of experiments made on this Station during the past year, and also a review of the progress of the Sorghum Industry in the United States. The latter was prepared by request for the State Agricultural Society and read at its last annual meeting in Shreveport.

Respectfully,

WM. C. STUBBS, Director.

SORGHUM.

Three and a half decades have passed since Leonard Wray, the great pioneer of sorghum industry, introduced into the United States Chinese sorghum and African Imphee. Along with the seed, came printed statements of the value of these plants and their adaptability to the economical production of sugar. Since that time they have had a checkered career. During the war, sorghum was largely cultivated in the South. It was manufactured in a crude way into a very indifferent syrup, which was highly prized by the Confederate soldier. From its discovery up to the present time, granules of sugar have been occasionally found in barrels of sorghum syrup, and many predictions as to its becoming a valuable sugar making plant, have been based alone upon these observed facts. In China, however, we are authoritatively told that though grown for several thousand years, it has never been used for either sugar or syrup making. The attempt to make sugar from sorghum has been almost exclusively confined to Americans. It is curious to find such contradictory opinions and opposite views positively asserted by the earlier writers on sorghum. Nothing definitely was known until 1878, when the Department of Agriculture at Washington undertook the investigation of the plant and its products. Since that time, these investigations have continued with varying fortunes, until the graud culmination at Fort Scott, has announced such a decided success, as to create again the hope that the United States can grow all the sugar it consumes. It is even proposed from our Southern cane, sorghum and beets to produce sugar not only for home consumption, but an abundant surplus for export.

That sorghum contains sucrose which under certain conditions, can be eliminated in as pure a form as that from sugar cane has been demonstrated time and again in the most authentic manner. Dr. Collier, the chemist who made the first investigations in sorghum early became such an enthusiast that his ac-

tions exasperated his chief and caused a separation. Convinced by the results of his official experiments, he boldly persisted that sorghum sugar could be made for one cent per pound. Emboldened by these investigation, the States of New Jersey, Illinois, Minnesota, Wisconsin and Kansas, started at once factories for the manufacture of sugar from sorghum. Minnesota and Wisconsin were north of the sugar latitude, and only syrup could be made. Their seasons are too short to permit of that maturity so essential to the elaboration of sugar in the plant. Excellent syrup in large quantities continued however to be a product of these States. The first results at the large sugar works at Champaign with their vacuum pan, hot rooms and centrifugals were so encouraging that a perfect thrill of delight permeated Illinois and remained till a subsequent season demonstrated the capacity of only 40 lbs. of sugar to the ton of sorghum, when disappointment displaced delight, and her people and her factory "shut up." In Kansas and New Jersey, where liberal State bounties were paid, the industry was more persistent. In New Jersey it has outlived the State bounty which expired by limitation two years since, while we find its factory doing excellent work the past season under the able administration of Dris Cook & Neale. The Rio Grande Works near Cape May, New Jersey, has been a series of failures. Starting eight years ago, with a paid up capital of $250,000, it modeled its works after those used in the manufacture of sugar from cane. A few seasons of financial failures demonstrated the folly of such works. The roller mills failed to extract one half of the juice in the sorghum, and disaster was inevitable. With courageous zeal, the intelligent managers, abandoned these works in the midst of sugar making, purchased a diffusion plant of the Franco-German patent for beet roots, and tried to adapt it to sorghum. Result, another disastrous failure. Undaunted, they made another trial. Seeing the sorghum gradually growing in sugar each year, and yielding under scientific influences to climate and soil, they knew that machinery could be devised by which it could be profitably extracted. Experiments had shown that diffusion extracts dark colored and bitter tasting compounds from the leaves and sheaths of unstripped canes,

which make the products almost unsalable. Accordingly machines were devised and constructed by which the cane was rapidly stripped, cleaned, cut and shredded. Such machines are now pronounced essential to the successful working of sorghum into sugar. The average yield per acre for five years up to last year has been only 308 lbs. of sugar. Last year it reached an average of 1400 lbs., with a maximum of 1970 lbs. of first sugars, and 112 gallons of molasses.

The sorghum plant in China is poor in sugar and sensitive to frost. At Rio Grande it has been acclimated so that it will stand quite a severe frost with ice, and been educated to imbibe five times its normal dose of sugar. Such results so deservedly merited from the persistent energy of its intelligent managers, is exceedingly gratifying especially when it is remembered that State bounty was withdrawn two years ago.

Encouraged by the prospects of diffusion extracting all the sugar from cane, the citizens of Ottawa, Kansas, led on by Hon. W. L. Parkerson, established at that point a few years since a large and complete factory. It is merely necessary to say here that it failed, after the promise of great success.

Convinced that only a few more persistent and intelligent efforts were needed to. wrest from sorghum the sugar which it contained this same Mr. Parkerson, repaired to Fort Scott, and there erected the Parkerson Sugar Works, whose name and fame are now written and spoken in every tongue. With national aid, liberally bestowed, with scientific skill bending its energies upon one single accomplishment, with improved machinery erected for a sole purpose, the Parkerson Sugar Works of Fort Scott, Kansas, sounded its determined attack upon sorghum early in the fall of '86, and millions of souls awaited the issue with intense solicitude.

The interest deepened as time wore on, and the dailies with intelligent correspondents at the seat of war, were denounced for withholding the news from Fort Scott. Foreign countries had sent embassadors to investigate and report upon this strange plant which under the influence of diffusion was to revolutionize the sugar world, add the name of Fort Scott to the commercial

sugar marts upon the blackboards of sugar exchanges, and make all Kansas rich and happy. It is a pity to say failnre to all these high hopes and bright anticipations, but the truthful chronicler of history has so recorded, and the chemist in charge has officially announced "the absolute failure of the experiments to demonstrate the commercial practicability of manufacturing sorghum sugar" which fell upon our intelligent Commissioner of Agriculture "like a wet blanket," to say nothing of the chagrin and grief, amounting to almost discouragement which followed.

"Human fortitude is equal to human calamity" was one of the impressive sentences contained in the "farewell address" of Lee to his army at Appomattox, and its truth has been fully verified in the history of the Parkerson Sugar Works. Undaunted by failure, and urged to renewed exertions by the unjust attacks of carping critics, the courageous managers calmly surveyed the field of disaster, reviewed the causes as far as known, and calmly resolved upon another trial. Defective and superfluous machinery was removed, uncertain or useless processes were eliminated, pet theories were abandoned and simplicity and pure science left to conduct a campaign, which has attained a success that finally places sorghum sugar making among the profitable industries of this country. The success of '87 at Fort Scott is due 1st, to the almost complete extraction of the sugars from the cane by diffusion. 2nd. The prompt and proper treatment of the juice in defecating and evaporating. 3d. The efficient manner in which the sugar was boiled to grain in the strike pan.

According to the report of General Manager Parkerson, the cost of labor and fuel per ton of cleaned cane was $1. The estimated cost of salaries, wear and tear of machinery etc., another dollar, making a total of two dollars per ton for manufacture. "Upon this basis with the same yield of cane and product secured this year, it requires but little figuring to show that we have developed a business of great interest and profit to our State and nation," is the conclusion of Mr. Parkerson.

The total cane worked into sugar 2,643 tons; the total sugar made 235,826 lbs.; or per ton of cane worked 89.2 lbs.

No second sugars were made—

The sugar sold for $5\frac{3}{4}$ cents and netted	$13,559 98
The State bounty was 2 cents per pound	4,716 52
Total	17,276 50
There were also 51,000 gallons (estimated) molasses at 20 cents	10,200 00
Seed valued at	7,000 00
Value of total product	$34,476 50

EXPENSES.

Paid for cane and seed	$ 9,614 00
Labor	5,737 16
Fuel	1,395 77
Salaries	3,500 00
Insurance, etc	1,500 00
Total expenses	$21,746 00

Total value	$34,476 50
Total expenses	21,246 93
Net	$13,229 57

Had the factory been in the South, and made the same yields, the account would have been different in the following: No State bounty; an increase of cost of fuel, and a probable decrease in the price of molasses.

There is however one feature of the above account which it is hard to realize:

The cane with seed cost	$9,614 00
The seed is valued at	7,000 00

Making 2,643 tons cane cost only $2,614, or not quite $1 per ton.

The financial success of the above, while highly gratifying to the manager, is not apparent upon close examination. The molasses and seed remain, and are estimated at $17,000.

Since the company, as we learn, has closed its works for the coming season, it is fair to presume that some of its stockholders do not regard the enterprise as profitable. However, the problem of making sugar from sorghum is solved, and the question is now only a commercial one. The following is an outline of the process at Fort Scott:

1st. The topped cane is delivered at the factory by the farmers.

2nd. It is cut by a machine into pieces 1¼ inches long.

3d. The leaves and sheaths are separated from the cut cane by fanning mills.

4th. The cleaned cane is cut into fine chips.

5th. These chips are diffused in iron tanks with hot water.

6th. The defecation of juice by lime.

7th. Concentration to syrup in double effect.

8th. Cooked to grain in a high vacuum strike pan.

9th. Purging of masse cuite by centrifugals.

With the exception of the works at Sterling and Hutchinson, Kansas, which were also failures, mention has been made of all the sorghum sugar factories in the North.

SORGHUM IN THE SOUTH,

Many speculations have been made as to the adaptability of sorghum for sugar making in the South, but no systematic attempt, so far as the writer knows, has been made previous to the experiments began two years since on the Sugar Experiment Station, near New Orleans. The following are some of the conclusions derived from two years of careful experiments: That sorghum, as a plant, is specially adapted to Louisiana, the Guinea corn, a true sorghum, growing wild almost everywhere, without cultivation, fully attests. Several hundred analyses made on different varieties of sorghums grown on this Station show a much larger amount of sucrose, a smaller amount of glucose and a higher coefficient of purity than the published analyses of the cane grown North. Indeed plants grown here are remarkably high in sucrose and low in glucose. It is possible also of growing two crops a year, as has been done, by using the seed of some of the earlier varieties. The Station has grown ten different varieties, and has found that they vary in tonnage, sugar content, period of ripening, and habits of growth. The Early Amber and Chinese varieties are too small to be profitable. The Honduras yields an enormous tonnage poor in sugar. Link's Hybrid, India, Enyama, and Early Orange, are varieties which yield fair tonnage and large sugar contents.

First and last, the Station has made a good deal of sugar

from sorghum, but it has encountered many difficulties, which only a careful scientific investigation will overcome.

Sorghum juice extracted by the mill is very impure, containing much starch, dextrine and kindred products, which are very objectionable and render the ordinary process of working sugar juices totally inapplicable. Starch is transformed by acids at all temperatures into dextrine and then into glucose. Is only partially precipitated by lime. Dextrine is not precipitated by any of the reagents used in the sugar house. In the presence of albuminoids ferments, fatty matter, etc., it causes a decomposition of the sucrose, producing fermentation of the lactic, butyric and viscous order. It is not crystallizable, but on the contrary accompanies the sugar to the strike pan, augmenting the masse cuite and restraining the sugar from crystallization. The excess of dextrine in the sorghum juices, most of which, it is believed, comes from starch, whose grains are ruptured by the pressure of the mill upon the cane, is a standing obstacle to the successful manufacture of sugar all the way from juice to masse cuite. It prevents thorough clarification by lime. It hinders filtration in the filter press, either when the scums alone or mixed with lignite, are treated.

It prevents crystallization in the pan, except at a high vacuum and low temperature, and it almost successfully resists the purging of the sugar crystals after the masse cuite gets cold. With mill juices, therefore, some defecating agent must be discovered whereby these impurities can be removed before sorghum juices can be economically treated for sugar. Diffusion fails to extract anything like the same amount of impurities and its juices are much easier worked, exhibiting however the same marked peculiarities, though in much lower degree. It may therefore be asserted that new and improved methods of working sorghum are earnestly desired and will doubtless be soon forthcoming. Till then diffusion seems to be the only practicable method of extracting the juice. Fair clarification may be done with Tannic Acid and Lime. Concentration should be done at once in vacuo, and cooking to grain must be done in a high vacuum and a low temperature. The crystals

are more easily purged when hot, taking even then twice or thrice the time required for cane sugar.

EXPERIMENTS IN SORGHUM AT THE SUGAR EXPERIMENT STATION IN 1887.

Seven varieties were used, viz: Honduras, Link's Hybrid, Enyama, White Mammoth, White India, Early Orange and White Seeded variety, from Ephraim Link, of Greenville, Tenn. Last year a very early planting gave matured cane in July and August. Accordingly this year planting was deferred till April 21st at which time also the following manures well mixed, were applied to the plat of 1½ acres:

400 lbs. Cotton Seed Meal, 300 lbs. Acid Phosphate, 100 lbs. Kainite.

A fair stand was secured, but the excessive rains in June prevented further cultivation than a mere thinning of the plants, and one good plowing. August 1st analyses of the different varieties began, which continued till grinding. Results are appended.

ANALYSES OF SORGHUMS.

Variety.	When Analyzen.	Total Solids	Sucrose.	Glucose.	Purity Coefficient.	Glucose Ratio.	Remarks.
Honduras	Aug. 1	9.6	4.8	....	50.	.....	Selected stalks
"	Aug. 17	11.1	6.6	3.8	59.46	57.57	"
"	Aug. 23	11.7	7.6	3.8	64.95	50.	"
"	Aug. 24	12.8	8.3	1.88	64.84	22.65	"
"	Sept. 9	11.9	7.2	2.66	60.50	36.94	"
"	Sept. 30	10.1	5.3	2.50	52.47	49.22	Mill juice
Link's Hybrid	Aug. 1	11.9	5.6	....	47.05	.....	Selected stalks
"	Aug. 3	11.9	8.9	1.45	74.79	16.29	"
"	Aug. 9	14.4	8.2	1.70	56.94	20.73	"
"	Aug. 10	12.6	10.8	1.14	85.71	10.55	"
"	Aug. 12	11.3	8.0	1.33	70.79	16.62	"
"	Aug. 16	15.7	12.3	.90	78.34	7.31	"
"	Aug. 17	16.2	13.2	.74	81.48	5.60	"
"	Aug. 24	15.3	12.5	1.05	81.69	8.4	"
"	Sept. 9	14.7	11.4	.91	77.55	7.98	"
"	Sept. 24	14.1	10.6	.94	75.17	8.86	Mill juice
White Mammoth	Aug. 1	14.2	8.3	....	58.45	.....	Selected stalks
"	Aug. 23	14.6	11.0	2.00	75.34	18.18	"
"	Sept. 9	14.4	10.8	1.50	75.	13.88	"
"	Sept. 27	13.7	9.6	1.21	70.07	12.60	Mill juice
India	Aug. 1	14.4	9.7	....	67.36	.....	Selected stalks
"	Aug. 20	12.2	9.5	1.64	77.87	17.26	"
"	Aug. 24	12.2	9.3	2.20	76.23	23.65	"
"	Sept. 9	14.8	12.1	1.10	81.75	9.99	"
"	Sept. 28	14.6	10.1	1.04	69.17	10.29	Mill juice
Early Orange	Aug. 1	11.7	6.5	....	55.55	.....	Selected stalks
"	Aug. 24	13.5	10.5	1.40	77.77	13.33	"
"	Sept. 9	15.8	12.0	2.66	75.95	22.16	"
"	Sept. 29	13.7	8.9	3.20	64.96	35.95	Mill juice
Enyama	Aug. 1	16.6	10.5	....	63.25	.....	Selected stalks
"	Aug. 23	15.8	11.9	2.70	75.31	22.69	"
"	Sept. 9	16.8	13.5	.90	80.95	6.66	"
White Seeded	Sept. 9	13.9	9.8	.98	70.50	10.	"

From above, we find a great difference in the time of maturity of the varieties used as well as in the content of sucrose and glucose at maturity. The falling off in sucrose of the same varieties from their sugar content of last year is also very notable. This was very astounding in the Honduras. Last year it polarized as high as 14.2 per cent in selected stalks, and 9.7 per cent in the mill juices, Sept. 14th. This year the highest polarization was 8.25 per cent in selected stalks, and only 5.3 per cent in mill juice, Sept. 30. Was this due to the late planting and the excessive subsequent rains which quickly pushed them to maturity.

Whatever the cause the fact remains that the average sugar content this year is fully 33⅓ per cent below that of last year.

Only small quantities of Enyama and Link's White Seeded were planted, and hence analyses were made of these only on selected stalks.

The other five varieties were each passed separately through the sugar house, with the following results:

SUGAR HOUSE RESULTS.

LINK'S HYBRID.

Yield per acre, 12 tons.
Mill extraction, 61 per cent.
Seed tops of stripped cane, 7.5 per cent.
Masse cuite not weighed.
Masse cuite yielded 55 per cent unwashed sugar, which polarized 94 per cent. It was grained in the strike pan by withdrawing the heat, forming a large number of small grains.

WHITE MAMMOTH.

Yield per acre, 12.50 tons.
Mill extraction, 60.50 per cent.
Seed tops of stripped cane, 3.00 per cent.
Masse cuite per ton. 143.00 lbs.
Masse cuite yielded 47.20 per cent of unwashed sugar, Grained in pan like Link's Hybrid.

INDIA.

Yield per acre, 11.25 tons.
Mill extraction, 59 per cent.
Seed tops of stripped cane, 7.8 per cent.
Masse cuite not weighed.
Masse cuite gave 57 per cent of unwashed sugar. Grained in pan like above.

EARLY ORANGE.

Yield per acre, 12.25
Mill extraction, 60 per cent
Seed tops of stripped cane, 8.8 per cent.
Masse cuite not weighed.

HONDURAS.

Yield per acre, 15.61 tons.
Mill extraction, 65 per cent.
Seed tops of stripped cane, 6.6 per cent.

The sugar was so low in this, that it was made at once into syrup, which sold at 37 cents per gallon.

Our trouble in the sugar house arose from the large amount of dextrine and starch present, which prevented clarification, hindered filtration, irritated the sugar boiler in his attempt to grain in the pan, and almost defied successful purging in the centrifugal, especially when the masse cuite became cool. With the exception of the Early Orange, which was overripe, all the varieties made into sugar were exceedingly low in glucose. Indeed with high purity coefficients and low glucose ratios, it was almost exasperating to encounter unexpected difficulties all through the manufacture. The small area in sorghum and the limited number of experiments, prevented any extended efforts in eliminating our difficulties. Much information was gained which will be of practical benefit next season. Our largest yield was about 70 lbs. sugar to ton of cane upon a 60 per cent extraction. A goodly quantity of sugar was made first and last, but much of it was wasted in our improvised efforts to expedite manufacture.

Will sorghum then be a sugar producing plant? We answer yes. There are many varieties of sorghum, some of them quite rich in sugar. This plant easily assumes new varieties under changed conditions. Let the best varieties be selected and crossbred with the single purpose of making sugar, saving no seed except from stalks showing a high per centage of sugar and low per centage of other solids. Use such manures and such cultivation as will aid in the attainment of our end, and we verily believe a true sugar bearing and sugar yielding sorghum of fixed habits may be obtained. Thus the sugar beet has and is being developed.

COTTON AND ITS PRODUCTS.

BULLETIN No. 13

OF THE

State Experiment Station

BATON ROUGE, LA.

WM. C. STUBBS, PH. D., DIRECTOR.

ISSUED BY
THOMPSON J. BIRD,
COMMISSIONER OF AGRICULTURE,
BATON ROUGE, LA.

LA. STATE UNIVERSITY & A. & M. COLLEGE,
BATON ROUGE, LA.

MAJOR T. J. BIRD,
Com. of Agriculture,
Baton Rouge, La.

Dear Sir :

I hand you herewith a Bulletin on Cotton, covering the essay read before Louisiana State Agricultural Society at its late meeting in Shreveport, together with results of experiments and some suggestions as to the use of Paris Green in destroying the cotton worm. I also include a receipt for making the compost, so frequently called for. The issue of this Bulletin as you know, has been unavoidably delayed.

Respectfully submitted,

WM. C. STUBBS.

COTTON.

Cotton belongs to a large class of plants, known to the botanists as Malvacae. Of this class, beside cotton, we have in cultivation the okra and the hollyhock. There are said to be many species of cotton—two of which only are cultivated in the south—the one upland or common cotton; "Gossipium Herbaceum," the other "Sea Island cotton," "Gossipium Barbadense." The latter is cultivated only on the coast or neighboring islands, while the former constitutes the chief staple of the Southern States. The bloom of upland cotton is white or cream colored the first day, turning red on the next and falling on the third, leaving a small boll enveloped in the calyx. This boll continues to develop until it reaches the size and shape of an egg, when on maturity it splits into three to five cells, containing the seed, wrapped in a tomentose wool. This wool constitutes the lint or fibre which clothes the world.

HABITUDES.

Cotton is emphatically a child of the sun and flourishes only in warm latitudes. Its heliotropic tendencies are even more marked than the poetical sunflower. Its leaves receive the first glow of morning light and following the king of day, dismiss it at eve in the west with dewy regrets. With us it is an annual herb. Further south it appears to be a shrub, while under the tropics it is a small tree, enduring many years. It is en exogenous plant, with two seed leaves and a long tap root. Among our field crops it stands without a fellow—alone—and peculiar in its habits and characteristics. Its nearest relation among our cultivated plants, as before mentioned, is the okra, with which it crosses, to form some of the many evanescent varieties of okra-cotton, now on the market. By its long, deep tap

root, it is enabled to withstand droughts and to pump up from the lower layers of the soil, plant food, unavailable to fibrous rooted plants, which is quickly assimilated by its large leaf surface. Hence it thrives better on poor land than any other land than any other field crop.

Formerly cotton was not grown north of the isothermal line 36 degrees, but under the influence of phosphatic manures, its cultivation in late years has been extended several degrees beyond this line. The region best adapted to successful culture is included between the 30th and 35th degrees of north latitude. North of this belt the seasons are too precarious, while south of it, excessive rains and depredations of the caterpillar greatly interfere with large production.

PLANTING AND CULTIVATION.

The soil best adapted to cotton is yet not fully decided. Clay loams, well drained and sandy loams, resting upon clay subsoils are both highly recommended. Both should contain a fair amount of vegetable matter.

The width of the rows and the distance apart of the stalks in the row, must depend upon the fertility of the soil and the rain supply. In poor lands or on soils subject to drouth during fruiting season, thin planting must be practiced to obtain the largest results. Mr. David Dickson, the great cotton planter of Georgia, now no more, always contended that cotton needed distance only one way. If, therefore, the rows were wide, it could be crowded in the drill and vice versa.

Deep and thorough preparation of soil, followed by pulverization should always precede planting. The planting should be done by some of the excellent and cheap cotton planters now to be everywhere found, since only the machine will give that uniform and straight stand, which so facilitates the subsequent chopping. It furthermore economizes the seed, a point of great importance, when the true value of this article as a manure and feed stuff is appreciated. The first plowing of cotton may be as deep and thorough as possible, but all subsequent workings ought to be as shallow as the character of the land will permit,

since root-breaking to this plant is almost a disaster. After every heavy rain the soil should be stirred and during drought a shallow implement run just deep enough to break the continuity of the pores of the soil and to form an upper layer, which shall act as a mulch to conserve the moisture in the soil, has often been found highly beneficial.

GRASS

is an enemy of the cotton planter and should never be permitted (if possible to prevent) to obtain possession of his fields. In cotton as in all other crops the hoe should be used as little as possible. It is an element of cost excessive to bear and with this plant often causes the disease known as "sore shin" by breaking or removing the epidermis of the tender stalk in the effort of the hoemen to remove the last spire of grass.

When to plant must be decided by the climate and by the character ot the soil. When the ground is warm enough to promptly germinate the seed and give a vigorous healthy plant, then the seed can be wisely trusted in the earth. This is usually the case in this latitude in April.

Planting in May is often hazardous, on account of the delay in germination, due to the prevalence of drouths at this period. When May planting is practiced, the seed should be covered rather deeply and firmed with a light roller.

A practice prevails among some of our progressive planters to plant late and highly fertilize. By this means they claim a crop of grass, which so frequently infests an early planting, is destroyed, the costly hoe labor avoided and the plant pushed quickly into vigor by the underlying fertilizer, soon occupies the ground and renders the after culture both simple and inexpensive. As a rule, it is best to plant poor unfertilized lands early and rich or highly fertilized lands late.

The manures for cotton. The composition of cotton is nearly constant for all latitudes. If the same were true of soils nothing would be easier than to prescribe definitely a manure for cotton adapted to all soils in every latitude. But nature has designed differently. There were many dynamical

agencies in the geological evolutions of mother earth, and we find evidence of their work in our great variety of soils (sometimes in the same field.) This variation in the composition of soils is a source of great perplexity to every agricultural chemist, especially when he is almost daily called upon to give formulas for manures for all crops upon all kinds of soils, many of which he has, perhaps, never seen. Let it be understood once for all that only by direct experiments upon each kind of soil can its wants be told, and to make these experiments is a part of the business of an experiment station.

On the worn lands of the archaean formation of the Atlantic slope, east of the Appalachian range and on the tertiary soils immediately on the coast, extending from Virginia to Mobile, Ala., excluding the cretaceous or prairie belt of Alabama, it has been found by numerous experiments that a fertilizer containing three per cent. of ammonia, ten per cent. of available phosphoric acid, and two per cent. of potash is specially adapted to cotton. These ingredients in the above proportions are furnished in the best form by a mixture of 100 bushels of cotton seed, 100 bushels of stable manure, one ton of acid phosphate, composted in the proper manner. In fact, the intelligent and progressive farmers of Georgia and Alabama prefer this to any other fertllizer.

It not only supplies the above ingredients in most available forms, but restores to the land a considerable amount of humus so essential to large production.

Compost, compost, is the word. The modern olympus is a compost heap and the God enthroned on it is called Jupiter Ammoniac.

In the absence of cotton seed and stable manure, the above ingredients maybe furnished in the mixture of 700 pounds of cotton seed meal, 1,100 pounds of acid phosphate, 200 pounds of kainit, which is fully the equal of the best guanos on our market and may be obtained either mixed or unmixed at any of the factories in New Orleans. Experiments in Louisiana, made at the station, and by planters, under the direction of the station, have proven the adaptability of the above mixtures to our soils. On lands badly worn and very deficient in vegetable matter,

the seed and meal can be advantageously doubled. While on lands, with a tendency to excessive weed, they may be decreased even to obliteration, using only acid phosphate and kainit.

Varieties of cotton. There are many so-called varieties of cotton on our market and each year adds to the already extended list. Some few have great merit, while others are utterly worthless. Last year the station grew twenty-two so-called varieties and carefully compared, first, the yield per acre; second, weight of 100 bolls; third, the per centage of lint, and fourth, length ofstaple with actual market value.

The utter absence of merit of any kind was the conspicuous feature of most of them. In yield there was no decidedly marked difference. The weight of 100 bolls varied from sixteen to twenty-five ounces. The number of seed per bushel was from 95,000 to 146,000. The per cent. of lint varied from 24 to 37 per cent. The valuable lesson of these experiments, which are published in full at the end of this Bulletin, is the difference in the yield of lint, showing the folly of growing a variety which will yield only 24 per cent of lint, when a yield of 37 per cent is obtainable by another variety. In length of staple the difference was quite small, as attested by the New Orleans market, where each variety was carefully sold on its merits, bringing $8\frac{7}{8}$c. and $10\frac{1}{8}$c. as the lowest and highest prices.

CONDITIONS FOR A GOOD CROP OF COTTON.

Thorough drainage, fair stock of vegetable matter in the land, excellent preparation of the soil, good seed properly planted, judicious manuring, both in quantity, quality and mode of application, early culture, deep and thorough, after culture frequent and as shallow as possible for good work. a laying by as early as is consistent with cleanliness and good condition and worms quickly poisoned as they appear. All these things being accomplished, nature will do the rest, and a reasonably large crop may be confidently expected. The following, taken from the Atlanta Constitution, shows what has been done in Georgia the past year. Can't Louisiana with her fertile soil do as well?

We print this morning the list of awards in the third annual contest for premiums offered by Geo. W. Scott & Co. These premiums are of the best five acres in cotton, the best single acre in cotton, and the best single acre in corn—all to be fertilized with Gossypium Phospho.

The awards show that Mr. Robert G. Ray, of Douglas county, raised 9,688 pounds of cotton on five acres; George W. Truitt, of La Grange, 8,666, and Mr. J. T. Wyatt, of Jasper county, 5050. On a single acre Mr. James W. Mason, of Palmetto, raised 2677 pounds; Mr. R. G. Ray, 2556; Mr. George W. Truitt, 2,087; Mr. J. H. Widner, of Coweta county, 1,775, and Mr. Smallprice, of Sumpter county, 1,682. Mr. Mason and Mr. Ray took over five bales of five hundred pounds each from a single acre.

Now, what does this mean?

Mr. Ray raised twenty bales of cotton of five hundred pounds each, on five acres. The average throughout Georgia last year was one bale to three acres, so that the average Georgia farmer occupied sixty acres with a crop to get what Mr. Ray took from five acres. The average farmer had to plow, plant and cultivate sixty acres, while Mr. Ray cultivated five acres and got the same amount of cotton. He used fifty-one hundred pounds of fertilizer on the five acres, which cost him $70. The cotton yielded him $970. Not only was he saved the labor of cultivating fifty-five surplus acres, but those acres were either lying fallow or were put down in grass or other crops. Mr. Truitt, who this year took eighteen bales of five hundred pounds each from five acres, is cultivating less land than he cultivated five years ago. He got more cotton from it this year than ever before, and has three hundred tons of hay for sale besides.

These farmers have reduced their cotton acreage from sixty acres to five, and have put the other fifty-five acres into other crops. This, it seems to us, is the secret of successful farming.

COMPOSITION OF THE COTTON PLANT.

A five hundred pound bale of lint cotton will require fifteen hundred pounds of air dried "seed cotton." Of the latter one-third, or five hundred pounds is lint, another third or five hundred pounds is hulls and the remaining five hundred pounds is kernels. To produce this fifteen hundred pounds of seed cotton, there will be required five hundred pounds of leaves, fifteen hundred pounds of stalks, five hundred pounds of roots and five hundred pounds of bolls and burrs. In other words to produce a five hundred pound bale of lint cotton, an acre must produce forty-five hundred pounds of vegetable matter, or two and a quarter tons.

To produce this amount the following mineral ingredients will be required: Phosphoric acid, potash, lime, magnesia, sulphuric acid, oxide of iron, chlorine, soda and silica.

In other words a soil must furnish the above ingredients besides a goodly amount of nitrogen to make a five hundred pound bale of cotton.

But fortunately most soils hold large contents of all these ingredients and supply them abundantly to all plants, except phosphoric acid, potash and nitrogen. To supply these needed ingredients is the prime object of manuring. But when the cotton planter makes the proper disposition of the products of cotton, let us see how far he needs the aid of manure to maintain the original fertility of his soils. The leaves and capsules should be permitted to fall to the ground and not removed, as is usual, by the depredations of half starved cattle. The stalks should be knocked down and plowed under instead of being destroyed by fire. The seed should be returned to the soil, or else when sold to the oil mill their equivalent in a first class commercial fertilizer should be purchased. When all this is done only the trifling loss of about one-half pound of phosphoric acid and two pounds of potash is sustained to each acre. Theoretically, then, cotton is the least exhausting crop grown, but how is it in practice? Unfortunately the decennial census returns cry out in thunder tones against us and tell the world in convincing figures that our acre yields are fast decreasing under constant cropping in cotton. Our soils are being rapidly depleted and exhaustion will sooner or later come, unless we stop the numerous leaks now found on many cotton plantations. Wisdom and economy would suggest the careful return to the soil of every product of cotton save the lint. But there are two incidents in cotton growing which tend in themselves to soil depletion, which are usually overlooked by the agricultural chemist, and rarely appreciated by the planter. First. Cotton is planted in early spring and harvested in late fall, its period of growth extending through the entire summer and much of the fall. During this period of growth with clean culture under hot suns, nitrification is most intense and with it a rapid oxidation of the vegetable matter of the soil. This partially explains why cotton is the most profitable crop on poor land, but it also tells in plainer language, that the vegetable mould "humus," so essential to fertility, is fast disappearing and with it soil nitrogen. Even

our rich alluvial lands once thought inexhaustible, from this cause, coupled with the baneful practice of selling cotton seed, are now responding in gratifying returns to the well directed use of nitrogenous manures. A crop of pea vines turned under every second or third year would aid materially in restoring this lost humus.

Second—Cotton is removed in late fall and our lands are left naked, unoccupied and exposed to the drenching rains of our semi-tropical winters, and much of the finer material, which furnishes the plant food in all soils is washed away, and a goodly quantity of plant food is carried so far down into the soil as to be forever beyond the reach of plants, even the tap root of cotton. The first loss is very severe in rolling or hilly lands, as is shown by the numerous furrowed hillsides which everywhere meet the eye of the traveller through the South Atlantic States. The second loss is greatest in sandy lands and least in clay. It has been clearly demonstrated that a loss of soil fertility will always occur whenever lands are left in bare fallow. A plant suitable for occupying the ground between the gathering of one crop and the planting of another, would be an inestimable boon to the cotton planter. Oats sown in the cotton in August or September and lightly harrowed in; or planted in October and November, after the cotton has been harvested affords only a partial remedy.

UTILIZATION OF THE PRODUCTS OF COTTON.

"The cotton fibre can be bred up just as a breed of horses can be improved," says Mr. Thomas Pry, who has been for eleven years studying the cotton fibers in the cotton fields of China, India, Arabia, Egypt, Mexico and America, and there is no apparent reason why our staple should not improve each year. Instead of that, little or no effort is made at improvement, and dirty cotton, badly packed, is to-day as common as years ago. This should not be. Care is necessary all through a cotton crop, and will pay here as everywhere else. Perhaps this indifference arises from a knowledge of the vast amount of speculation between the planter and consumer. A rehearsal of a few

may be apropos to this occasion: First, our compulsion to use the patent heavy iron bands made by a monopoly stock company, with millions of capital, upon which they pay enormous dividends, when neat steel wire bands, at one-fourth the cost would secure our cotton ; second, putting up our cotton in loose, large, and ungainly bales, that every factor in every city through which it passes may get his pound or two of sample, and the compress its fee for compressions. Follow a bale of cotton from the planter to the consumer, through the number of rings which fatten on it, drag it through the mud and slush with an ignorant careless drayman, expose it to rain on rail and boat, dump it on a muddy, unsheltered wharf, store it in some dirty warehouse until the call of the inspector of some factory, who takes it in hand, cuts the coverings, removes the outside soiled cotton until all is as white and clean as lint from the gin, and samples again this much sampled bale; then the cotton is weighed, the weight of covering, ties and soiled cotton deducted, and the consumer buys at this weight.

Be not deceived farmers and planters, when you think you are getting paid for your bagging and ties and mud and water on your cotton. Far from it; the middle-men know too well the shrinkage and peculation in which they share, to pay just enough for your cotton to cover all deductions and leave them handsome profits, Mr. Edward Atkinson who has carefully studied the subject, declares that there is a loss of 10 per cent. in waste between the planter and consumer, in the manner of handling our crop, or upon our present crop, over $30,000,000. Were political carpet-baggers robbing us of ten per cent, of our products, a howl of indignation, followed by a political revolution, would spread over this State. Yet we submit to this extensive loss, with scarcely a murmur of complant. Great reforms are needed in the improvement of the lint, the proper preparation of it for market, and more than all, the proper marketing of it.

COTTON SEED.

Each 500 pound bale of cotton gives 1,000 pounds of cotton seed. Estimating our present crop at 6,000,000 bales, gives us 3,000,000 tons of seed. Formerly these seed were permitted to

rot at the ginhouse, till an accident revealed their manurial qualities. Later, oil mills sprang into existence and the oil was expressed from the kernels. These oil mills, while they have been bonanzas of profit, have yet been in the past the only instructor of the farmer as to the value of seed. Deprecating their value for home purposes, they have managed to obtain seed at prices far below their value. However, the value of the products of cotton seed are now so well known that the time seems near when the seed shall equal the lint in price. Every ton of seed yields 22 pounds of short lint at 8 cents, $1.32; 35 gallons of oil at 32 cents, $11.20; 700 pounds of meal at $1.00, $7.00; 1,000 pounds of hulls at $3.00; total per ton, $22.52; cost of seed in New Orleans, $12.00, or nearly $10.52 for each ton manufactured. To a mill working 100 tons per day, surely a handsome profit. The mills in New Orleans pay $12.00 per ton for seed delivered. What the farmer receives depends upon his location and accessibility to market. But what are they worth to him as a manure? Cotton seed contains 3 per cent of nitrogen, 1.4 per cent phosphoric acid, and 1.14 per cent of potash. Applying the commercial tariff adopted by the association of official chemists in the South, we have a manurial value of $14.94 per ton. In other words, if he sells his seed and buys commercial fertilizer he would have to pay this much, by this tariff, for the ingredients contained in it. But the seed contains about 30 per cent. of oil which is of no value as a manure, and whenever they are used as such, the oil is simply lost. True patriotic economy would therefore suggest that the oil be extracted. In doing so however, two conditions should be imperatively observed. First, that the farmers should share in the heretofore enormous profits of the mills, and second, an equivalent in plant food to the seed sold, should be annually replaced in a good commercial fertilizer. Observing these, $75,000,000 could annually be added to the wealth of our country by the sale of five-sixths of our seed, after reserving one sixth for planting, and no detriment would accrue to our soil fertility. The large amount of oil in the seed makes it objectionable as a cattle food, and no combination with other foods can reduce it to the amount required for a perfect ration, while one of its

products, cotton seed meal, is the best supplement known for foods deficient in protein and fats. This, our English farmers have long known, and the price of our oil cake is regulated by the demand of English stock raisers. Highly instructive to the thoughtful planter is the seemingly paradoxical lesson taught us across the ocean, that the manure from a ton of cotton meal is worth more than the meal, the distinguished English chemist giving the value to the farmer of $27.60 per ton, while the latter is delivered at $25.00. The cattle have added nothing to the meal, on the contrary, they have extracted what was necessary to make flesh and blood, and voided nearly all of the fertilizing ingredients in a form easily assimilated by plants. True economy would therefore suggest the use of cotton meal first as a feed stuff and then as a manure. When the cotton planter realizing what a bonanza of wealth there is in his seed, shall add to his planting the more profitable business of stock raising, there will come that day of prosperity which the poet in fancy has painted and which the true student of agriculture has predicted as the legitimate natural inheritance of a land so peculiarly blessed as ours.

Cotton seed meal is largely used as a fertilizer, either alone or mixed with phosphate and potash. Experiments have demonstrated that the nitrogen of meal is fully the equal of that in any other form, and to-day thousands of tons of commercial fertilizers are vended with meal as their only source of nitrogen, Neither as a manure or as a food stuff should it be used alone. but in proper combinations it is a specific almost without a rival. There are now nearly one hundred oil mills in the South turning out annually about 30,000,000 gallons of oil. The query arises, what are they doing with this vast amount? The recent movement against the great corporation which a year ago bought up nearly all the oil mills in this country, have thrown a world of light on this interesting subject. The pork packers of the West have loaded this monopoly with invectives, and thrown the influence of their great wealth against it, because, forsooth, they made them pay five cents per gallon more for their oil with which they adulterated their lard. Messrs. Armour & Co. are reported as using annually as much as 8,000,000 gallons alone in their

business. The result to us is a large number of rival oil mills; increased prices for our seed and cheap lard. Cotton seed oil is almost identical in composition with olive oil, and is largely used to adulterate it. So great has been this adulteration that the Italian government a year or two ago levied a heavy tariff on the importation of cotton seed oil; since which time our olive oil has been made in New York. This oil is largely used in the South and West as a substitute for lard. Only prejudice can object to it since it is pure as olive oil and much purer than lard from hogs which have been unnaturally fed for adipose tissue. It is, however consoling to know that those whose refined tastes and delicate stomachs, will not tolerate cotton seed oil in their foods will have hereafter to raise their own hogs in order to obtain pure lard, and such a prejudice may after all transfer our smoke houses from the West to the South, where they ought always to have been. This adulteration of Northern lard with Southern oil has aroused Northern indignation, and already petitions have been presented to Congress, for a law to prevent it, while their righteous souls can find no harm in mixing Northern glucose with Louisiana molasses and sugar, and vending the mixture under the name of the latter.

Cotton seed oil is used as a burning oil in mines and as a lubricant. After treatment it is used as a paint oil, its drying properties equaling linseed oil. It is also successfully used in replacing olive oil in pharmaceutical preparations.

Hulls, which constitute one-half the seed, are burned under the boilers and furnish more fuel than is needed. Used with cotton seed meal they furnish a complete ration for cattle and stockmen assert that the two properly combined will add two to four pounds a day to a full grown beef. They are also used as a litter in stables. As a fertilizer they are inferior, containing a small amount of nitrogen and large excess of woody fibre, which prevent early decay in the soil. When burnt, they give an ash rich in potash, and with a fair proportion of phosphoric acid. These ashes are in considerable request as a fertilizer upon the soils of New England and New Jersey, where potash manures are badly needed. Upon the tobacco fields of Connecticut they are eagerly sought and highly prized. They are little used in

the South, our supply going mainly to the North at low prices. The cotton plant produces other valuable materials besides those already mentioned. The bark of the stalk makes a fibre of great beauty and high tension. The stalk makes an excellent pulp for coarse paper. Even the plant, after the seed has been picked might be cured into a rough hay. It has been proposed to ensilage the ground stalk with green fodder, with the expectation of the latter dissolving the former. The root yields a medicine described in the Pharmacopœa, well known to our untutored negroes. A dye has also been obtained from the same source, which is said to be of great promise. And now, in conclusion, permit me to say that no other crop has, within it so much promise and potency as that which we of the South have so long deified as king cotton. It clothes the world with the cheapest and best garments; it furnishes the lard for our kitchen, the oil for our salad, the butter for our bread, the soap for our toilet, and the candle for our bed-room. It feeds our Jersey cow, it fertilizes our garden and field-crops. It paints our houses, dyes our hosiery and makes our ointments. It furnishes us with paper, delicate enough to receive the sweetest strains of whispered love, or strong enough for the wheels of the ponderous locomotive. It gives us thread as fine as the spider's silken web, or strong enough to lash the navies of the world together. Such, now, is this wonderful plant, and who can deny the magnificent possibilities of its future?

MANURES FOR COTTON.

The experiments begun in 1886 have been continued with slight modification through 1887, though not with the success expected. The excessive rains of June destroyed the cotton on some plats which were badly drained and prevented an accurate comparison of results. The following were the questions propounded to our experiments:

1st. What ingredients of commercial manures do our soils need for the successful production of cotton. Having determined this we have.

2nd. What form of these ingredients was most beneficial to cotton.

3rd. What quantity produced the best results.

The first question is asked directly in plat 5 and incidentally in them all. The second and third questions are answered as to nitrogen in plat 5, as to phosphoric acid in plat 6, and as to potash in plat 7.

Plat 5 was devoted to nitrogenous manures, using the following as sources of nitrogen, viz: Nitrate of soda, 15 per cent. nitrogen; sulphate of ammonia, 21 per cent. nitrogen; dried blood, 10 per cent nitrogen; cotton seed meal, 7 per cent. nitrogen; fish scrap, 10 per cent. nitrogen, and tankage, 7 per cent nitrogen. The first and second are minerals, the fourth vegetable and the rest animal forms.

Besides the above, a mixture of nitrate of soda, sulphate of ammonia and cotton seed meal, called " mixed nitrogen " is also used.

Such quantities of each are used alone and in combination as to represent equal quantities of nitrogen and each are used alone and in combination in quantities representing 10½ and 21 pounds of nitrogen per acre. The following are the experiments:

PLAT V.

NITROGENOUS MANURES (calculated to the acre.)

Expt. No. 1.	No manure.	
Expt. No. 2.	140 lbs. Nitrate of Soda.	
Expt. No. 3.	100 lbs. Sulphate of Ammonia.	
Expt. No. 4.	210 lbs Dried Blood.	
Expt. No. 5.	300 lbs Cotton Seed Meal.	
Epxt. No. 6.	210 lbs Fish Scrap.	
Expt. No. 7.	280 lbs Acid Phosphate.	
Expt. No. 8-	80 lbs Muriate potash.	
Expt. No. 9.	300 lbs Cotton Seed Meal 280 lbs Acid Phosphate.	
Expt. No. 10.	300 lbs Cotton Seed Meal. 80 lbs Muriate Potash.	
Expt. No. 11.	No Manure.	
Expt. No. 12.	280 lbs Acid Phosphate 80 lbs Muriate Potash	*Mixed Minerals (see page 22)
Expt. No. 13.	70 lbs Nitrate Soda. Mixed Minerals.	
Expt. No. 14.	140 lbs Nitrate Soda. Mixed Minerals.	
Expt. No. 15.	Mixed Minerals.	
Expt. No. 16.	50 lb Sulphate of Ammonia. Mixed Minerals.	
Expt. No. 17.	100 lbs. Sulphate of Ammonia. Mixed Minerals.	
Expt. No. 18	Mixed Minerals.	
Expt. No. 19.	No Manure.	

Expt. No. 20.	105 lbs. Dried Blood. Mixed Minerals.	
Expt. No. 21.	210 lbs Dried Blood. Mixed Minerals.	
Expt. No. 22.	Mixed Minerals.	
Expt. No. 23.	150 lbs Cotton Seed Meal. Mixed Minerals.	
Expt. No. 24.	300 lbs Cotton Seed Meal. Mixed Minerals.	
Expt. No. 25.	Mixed Minerals.	
Expt. No. 26.	105 lbs Fish Scrap. Mixed Minerals.	
Expt. No. 27.	210 lbs Fish Scrap. Mixed Minerals.	
Expt. No. 28.	Mixed Minerals.	
Expt. No. 29.	No Manure.	
Expt. No. 30.	24 lbs Nitrate Soda 16 lbs Sulphate Ammonia 50 lbs Cotton Seed Meal Mixed Minerals	Mixed Nitrogen.
Expt. No. 31.	47 lbs Nitrate Soda 33 lbs Sulphate Ammonia 100 lbs Cotton Seed Meal Mixed Minerals	Mixed Nitrogen.
Expt. No. 32.	Mixed Minerals.	
Expt. No. 33.	150 lbs Tankage. 80 lbs Muriate Potash.	
Expt. No. 34.	300 lbs Tankage. 80 lbs Muriate potash.	
Expt. No. 35.	300 lbs Tankage.	
Expt. No. 36.	No Manure.	

The destruction of a portion of the above experiments by the excessive rains, prevented an accurate comparison of the seemingly discordant results. Hence the latter are not given. It was quite evident however, that the organic nitrogen gave better results than the mineral forms on this soil and crop. The excessive rains seem to have leached the latter beyond the reach of the roots in the early growth of the plant. Dried Blood and Cotton Seed Meal appeared to have produced slightly better results than the other forms of Organic Nitrogen. The present year, plats better drained have been selected for a continuation of these experiments, and they will be repeated both at Baton Rouge and Calhoun.

There were slightly increased results where double quantities of Nitrogen were used; perhaps not enough to justify increased expense.

*Mixed Minerals above always mean 280 lbs. Acid Phosphate, 80 lbs. Muriate Potash.

PLAT VI.

PHOSPHORIC ACID MANURES. (calculated to the acre.)

Expt. No. 1. No Manure.
Expt. No. 2. 280 lbs. Dissolved Bone Black.
Expt. No. 3. 280 lbs. Acid Phosphate.
Expt. No. 4. 280 lbs. Bone Meal.
Expt. No. 5. 280 lbs. Charleston Floats.
Expt. No. 6. 300 lbs. Cotton Seed Meal, 80 lbs. Muriate Potash, Basal Mixture. *
Expt. No. 7. 140 lbs. Dissolved Bone Black. Basal Mixture.
Expt. No. 8. 280 lbs. Dissolved Bone Black. Basal Mixture.
Expt. No. 9. Basal Mixture.
Expt. No. 10. No Manure.
Expt. No. 11. 140 lbs. Acid Phosphate. Basal Mixture.
Expt. No. 12. 280 lbs. Acid Phosphate. Basal Mixture.
Expt. No. 13. Basal Mixture.
Expt. No. 14. 140 lbs. Precipitated Dis. Bone Black. Basal Mixture.
Expt. No. 15. 280 lbs. Precipitated Dis. Bone Black Basal Mixture.
Expt. No. 16. Basal Mixture.
Expt. No. 17. 140 lbs. Precipitated Acid Phosphate. Basal Mixture.
Expt. No. 18. 280 lbs. Precipitated Acid Phosphate. Basal Mixture.
Expt. No. 19. Basal Mixture.
Expt. No. 20. No Manure.
Expt. No. 21. 140 lbs. Bone Meal. Basal Mixture.
Expt. No. 22. 280 lbs. Bone Meal. Basal Mixture.
Expt. No. 23. Basal Mixture.
Expt. No. 24. 140 lbs. Charleston Floats. Basal Mixture.
Expt. No. 25. 280 lbs, Charleston Floats. Basal Mixture.
Expt. No. 26. Basal Mixture.
Expt. No. 27. 90 lbs. Gypsum. Basal Mixture.
Expt. No. 28. 180 lbs. Gypsum. Basal Mixture.
Expt. No. 29. Basal Mixture.
Expt. No. 30. No Manure.

The phosphatic manures used above were represented by Dissolved Bone Black, Acid Phosphate, Precipitated Dissolved Bone Black, Precipitated Acid Phosphate, Bone Meal and Charleston Floats.

The same quantities of each were used.

* Basal mixture in this plat always means:
300 lbs. Cotton Seed Meal.
80 lbs. Muriate Potash.

Here too results were seriously vitiated by excessive rains, but there was quite an amount of evidence showing the superiority of the soluble forms of Phosphoric Acids over all others. There was no appreciable difference between the results from Dissolved Bone Black and Acid Phosphate.

PLAT VII.

POTASSIC MANURES. (Calculated to the Acre.)

Expt. No. 1. No Manure.
Expt. No. 2. 230 lbs. Kainite.
Expt. No. 3. 60 lbs. Muriate Potash.
Expt. No. 4. 120 lbs. Sulphate Potash.
Expt. No. 5. { 300 lbs. Cotton Seed Meal. / 280 lbs. Acid Phosphate. } Meal Phosphate.*
Expt. No. 6. { 240 lbs. Kainite. / Meal Phosphate.
Expt. No. 7. { 480 lbs. Kainite. / Meal Phosphate.
Expt. No. 8. Meal Phosphate.
Expt. No. 9. { 60 lbs. Muriate Potash. / Meal Phosphate.
Expt. No. 10. { 120 lbs. Muriate Potash. / Meal Phosphate.
Expt. No. 11. No Manure.
Expt. No. 12. Meal Phosphate.
Expt. No. 13. { 120 lbs Sulphate Potash. / Meal Phosphate.
Expt. No. 14. { 240 lbs. Sulphate Potash. / Meal Phosphate.
Expt. No. 15 Meal Phosphate.
Expt. No. 16 No Manure.

*Meal Phosphate in this Plat is always 300 lbs. Cotton Seed Meal [illegible]0 lbs. Acid Phosphate.

Here potash is furnished in the form of Kainite (12 per cent. potash), sulphate (24 per cent. potash) and muriate (50 per cent. potash).

Results here show that no form of potash has appreciably benefited cotton on this soil.

VARIETIES OF COTTON.

Twenty-two varieties were grown as nearly under like conditions as possible. These, were separately picked and weighed. At the close of the season they were again weighed and ginned upon an excellent gin, and the lint and seed carefully weighed. The varieties nearest alike in staple were baled together, and each bale was sent to New Orleans and sold on its merits. Besides the above, each member of my agricultural class, carefully selected fifty bolls from both the middle and top of each variety, weighed them carefully, ginned them by hand and weighed resulting lint and seed. In this way the percentages of lint and seed, weight of one hundred seed and number of seed per bushel were calculated. The same experiments were duplicated by myself and farm superintendent. The results obtained varied

greatly with some varieties, while nearly constant with others. It was curious to note the differences in weight between one hundred bolls picked from top and middle, also in yield of lint of some varieties, while on the other hand the results which each experimenter obtained on a few varieties, were surprisingly concordant. I append results results of sixteen varieties:

Names of Variety.	Per Cent. of Lint.		Per Cent. of Seed.		Weight of 100 Bolls.		Number of Seed to the Bushel of 30 pounds.
	By Hand.	By Gin.	By Hand.	By Gin.	Top.	Middle.	
					Ozs.	Ozs.	
Peterkin	37.63	37.30	62.37	62.70	20	20	146.320
Bramen	37.31	36.70	62.69	63.30	24	23	121.830
Boyd's Prolific	31.17	28.50	68.83	71.50	23	22	137.180
Allen's Long Staple	32.91	32.10	67.09	67.90	25	24	118.205
Tennessee Silk	29.62	28.40	70.38	71.60	17	20	110.260
Mallius Prolific	33.90	32.30	66.10	67.70	19½	18	115.420
Herlong	33.30	32.60	66.70	67.40	16	16	12[illegible].500
Jones' Improved	34.10	33.50	65.90	66.50	20½	22	9[illegible].970
Jowers Improved	35.91	34.40	64.09	65.60	17	20	12[illegible].890
S. B. Maxey's	31.60	32.00	68.40	68.10	17	18	110.790
Cherry's Long Staple	32.29	31.56	67.71	68.44	11½	18	135.810
Shine's Early	27.24	28.50	72.76	71.50	24	22	114.350
Griffin's Improved	31.70	30.50	68.30	69.50	22	20	95.160
Taylor's Improved	31.00	29.60	69.00	70.40	20	19	11[illegible].920
Bancroft's Herlong	33.42	32.80	66.58	67.20	17½	18	122.590
Sea Island	22.74	23.60	77.26	76.40	12	...	10[illegible].750

The above cottons brought in the New Orleans market from $8\frac{7}{8}$ to $10\frac{1}{8}$ cents. per pound.

THE COTTON WORM.

How to destroy it. Paris green, London purple and white arsenic, all compounds of arsenic are used for the destruction of this pest. Since all of the above are poisonous to man and best, they must be handled with great care and caution.

The almost unanimous opinion of farmers and planters is that of the above, Paris green is by far the best poison. It is used in three ways, first, in liquid suspension; mix one pound of pulverized Paris green, with forty gallons of water and put this on one acre, by and with a large watering pot or from the barrels placed in a wagon, by use of spray pumps. In either case the mixture must be kept well stirred, since Paris green is not soluble in water, but is held mechanically suspended; a little flour

just soured in a bucket of water and then added to the mixture, gives it greater adhesive power.

Second, dry, mixed with some deluent as cheap flour, yellow ochre, fine clay, plaster or ashes. A little dextrine is sometimes added to increase adhesiveness. One pound of Paris green is mixed with twenty-five pounds of the deluent.

This mixture, used during showery weather is sifted over the plants by hand, through coarse sieves.

Third. The finely ground Paris green is dusted from an oblong sack, made of course muslin, attached to the end of a long pole, carried by a man on horseback. In this way it is easily and cheaply distributed; the only objection is, that as ordinarily performed, more Paris green is used than is necessary. Care should be taken to keep man and beast on the side from which the wind is blowing, so as to avoid inhalation of arsenical dust.

Either of the above methods can be used with certainty of success, if proper care in following directions be exerted.

HOW TO MAKE A COMPOST.

"Compost and compost, again is the word. The modern Olympus is the compost heap and the God enthroned on it is called Jupiter Ammoniac."

Below is appended the formula best suited for cotton.

100 bushels Cotton Seed.

100 bushels Stable Manure.

1 ton Acid Phosphate, high grade.

If the above is to be used on very sandy lands, one-half ton of Kainite may be advantageously added. Dissolve in water and use the latter to wet the compost.

Since the success of a compost depends materially upon the proper manner of preparing it, full directions are here inserted:

DIRECTIONS FOR MAKING COMPOST.

Take an equal part of the Stable Manure, say ten bushels, and spread it out in a level place, under shelter, to the depth of

three inches. Sprinkle over it 100 pounds of Acid Phosphate. Next spread over this ten bushels of Cotton Seed, made thoroughly wet. Then another sprinkle of 100 pounds of Acid Phosphate. Continue this rotation till the quantities are exhausted and then cover with a rich earth, from the fence corners, five inches deep. Permit it to remain until ready for use, four to six weeks will do, and cut vertically down with a mattock. Mix well and apply from 300 to 1000 pounds per acre in the drill at the time of planting.

Be careful to wet the Cotton thoroughly and buy only a first-class Acid Phosphate.

SUGAR CANE.

(FIELD EXPERIMENTS.)

BULLETIN No. 14.

OF THE

LOUISIANA SUGAR EXPERIMENT STATION

Wm. C. Stubbs, Ph. D.,

—DIRECTOR—

KENNER, LA., JANUARY, 1888.

—ISSUED BY—

THOMPSON J. BIRD,

COMMISSIONER OF AGRICULTURE, BATON ROUGE, LA.

BATON ROUGE:

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1888.

SUGAR EXPERIMENT STATION,
Kenner, La.

Major T. J. Bird, Commissioner of Agriculture, Baton Rouge, La.:

Dear Sir—I hand you herewith for publication Bulletin No. 14—covering experiments in Sugar Cane, made during the past year on this Station.

Respectfully,

WM. C. STUBBS, Director.

ERRATA.

On page 8, in table 3, under the head of No. of Sprouts, omit all decimal points.

On page 30, line 1, read primarily for permanently.

On page 51, line 3, after table, 37 and 44, should read 37 to 44.

On page 52, 5th line from bottom, read time instead of vines, and on same page, 2d line from bottom read tap instead of top.

On page 60, line 11, read germination instead of fermentation.

On page 61, 18 should be 19 and 19 should be 18.

On page 66, 9th summary, 24 and 48 should read 24 to 48.

On page 69, in the lower table of No. of parts of cane, the second next to lower fourth, should read lower fourth.

On page 71, Milladen should read Milladon, Posey & Jones should read Pusey & Jones.

On page 72, line 6, read purgery instead of purging.

Field Experiments

In cane during the past year were of four kinds, viz:

1. Germination questions.
2. Physiological questions.
3. Varieties best adapted to Louisiana.
4. Manurial requirements.

These are but the continuation and in many instances the enlargement of the work of the previous year.

GERMINATION QUESTIONS.

The following from Bulletin No. 7, explanatory of our object, is herein inserted:

"It has long been a question among planters whether to plant the tops, the entire stalk, or only the matured part. The practice of planting the green unmatured tops is the one suggested by economy, since these contain little or no sugar, and are frequently thrown away. This practice is, however, severely criticised by some, upon reasons drawn from known principles of vegetable physiology. The cane, say they, has only sterile flowers, and consequently give no seed or grains. Therefore the eyes of the cane are intended to replace the true seed or grain. In all seed bearing plants, those seed germinate and fruitify best, which are permitted to reach perfect maturity. Therefore in imitation of this natural law, we must seek that part of the stalk which contains the largest and best developed eyes, in order to secure seed which will produce the most vigorous plants. It is further claimed that where tops are universally used as seed that a degeneracy of the cane will follow, since the latter is always reproduced with those parts of the cane where the juices are the poorest in nourishment (sugar) and the eyes the most imperfectly developed. Hence it is a practice with some of our planters never to plant fall cane until the polariscope shows at least 10 per cent, sugar in the cane. *Per contra* there are others who claim that the planting of the

tops is justifiable from purely scientific reasons, besides the economy involved. They regard the cane planted as "cuttings" rather than true seed, and the eyes as buds to be developed under proper conditions. They say that the florist when he wants to root new plants, never uses the old or mature wood, but rather the young and succulent portions. Therefore in planting cane the youngest and most succulent portions will secure the best results. Which is right has not yet been decided by science. Experiments in the field have demonstrated that eyes from both the mature and immature parts of the stalk will germinate. But which are the best, i. e. which will insure the best and surest results under the varying conditions of our seasons, soils and rainfall ?"

To determine this question, the following experiments were instituted with a view of continuing them through a series of years in order to eliminate as far as possible all the modifying factors, incident to one year's experiment. Great pains were taken to select healthy stalks of uniform length. These were cut up into short pieces beginning with the green immature top. Two eyes were left upon each cutting and each stalk was selected so as to give eleven cuttings. Seventy five of these cuttings containing 150 eyes were devoted to each experiment.

The land was in excellent order, having had a large crop of pea vines turned in early in the fall with a four horse plow. The cuttings were carefully deposited in each row and covered by a hoe. The following are the experiments:

PLAT O—GERMINATION QUESTIONS.

Experiment	No.	1—75	white immature joints of 2 eyes each.
"	"	2—75	joints next to No. 1 partially white, 2 eyes each.
"	"	3—75	" " " " 2 full red " " "
"	"	4—75	" " " " 3 " " " "
"	"	5—75	" " " " 4 " " " "
"	"	6—75	" " " " 5 " " " "
"	"	7—75	" " " " 6 " " " "
"	"	8—75	" " " " 7 " " " "
"	"	9—75	" " " " 8 " " " "
"	"	10—75	" " " " 9 " " " "
"	"	11—75	" butts, 2 eyes each.

These experiments were planted February 9th, and occasional observations were made, and the stalks upon each row

carefully counted, until suckering began. At harvest each row was weighed, the stalks counted, the juice separately expressed and carefully analyzed. Table No. 1 contains the number of stalks up at each observation, the number harvested with weights, the average weight of each stalk, the yield and number stalks per acre. Table No. 2 gives the chemical analyses of the juices, with "purity coefficient," "glucose ratios" and available sugar per ton.

TABLE 1.

PLAT O—GERMINATION QUESTIONS

Planting Different Parts of the Stalks of Cane February 9th, 1887.

Part of the Stalk Planted.	Number of stalks from 150 eyes planted counted.									Tons per acre	No. of Stalks per acre.
	Feb. 27	M'ch 10	M'ch 13	M'ch 17	M'ch 19	M'ch 23	At Harvest Nov. 3	Weight of Stalks	Average Weight of each		
1 Upper white joints	5	24	24	24	26	34	97	247 lbs.	2.54 lbs.	18.14	14.287
2 Next to " "	12	39	41	44	45	45	140	407 "	2.91 "	32.06	21.050
3 " " No. 2.	10	45	48	54	63	69	165	485 "	2.94 "	38.18	25.987
4 " " " 3.	4	27	34	39	45	51	152	428 "	2.82 "	33.75	23.940
5 " " " 4.	1	27	35	45	51	73	154	442 "	2.87 "	34.80	24.255
6 " " " 5	1	25	35	43	52	58	149	426 "	2.86 "	33.56	23.467
7 " " " 6.	0	19	20	25	33	40	147	400 "	2.72 "	31.48	23.152
8 " " " 7.	0	15	18	23	27	32	133	320 "	2.41 "	25.24	20.947
9 " " " 8.	1	19	23	28	34	39	130	340 "	2.61 "	26.82	20.552
10 " " " 9.	0	12	14	20	26	36	97	214 "	2.21 "	16.88	15.276
11 Butts*............	0	14	15	20	41	41	73	160 "	2.19 "	12.62	11.520

*This row was seriously injured in the summer by proximity to a Fig Tree.

TABLE 2.

PLAT O.—FIELD AND SUGAR HOUSE RESULTS NOV. 3.

Number and kind of Experiments.	Yield per acre in tons.	ANALYSES.				Purity Co-efficient.	Glucose Ratio	lbs. available sugar upon 70 p. c. extrac.	
		Degree Baume	Total Solids.	Sucrose	Glucose			Per ton	Per acre
1 Upper white joints	18.14	7.4	13.31	10.3	1.24	77.38	12.04	118	2141
2 Next " "	32.06	7.8	14.01	11.2	1.35	79.94	12.05	128	4104
3 " to No. 2......	38.18	7.6	13.71	10.3	1.28	75.12	12.42	117	4467
4 " " " 3......	33.75	7.3	13.21	10.0	1.60	75.70	16.	99	3341
5 " " " 4......	34.80	7.5	13.61	10.0	1.60	73.47	16.	99	3445
6 " " " 5......	33.56	7.8	14.01	10.9	1.35	77.80	12.38	124	4161
7 " " " 6......	31.48	7.3	13.11	10.5	1.28	80.09	12.19	120	3777
8 " " " 7......	25.24	7.8	14.01	10.6	1.35	75.63	12.73	120	3029
9 " " " 8......	26.82	8.	14.41	10.5	1.35	72.86	12.85	119	3192
10 " " " 9......	16.88	7.9	14.31	11.5	1.35	81.36	11.73	133	2245
11 Butts*............	12.62	8.4	15.01	12.0	1.21	79.94	10.08	143	1805

*Injured by shade.

One fact was apparent early in the season, viz, that the upper half of the cane germinates much more quickly than the lower half. The dry weather which prevailed during March and April, also demonstrated the incapacity of the young sprouts from the green immature part of the cane, to withstand severe drouths since many on this row perished during these months, while on no other row was there any loss. This fact led us to investigate the dead plants seen occasionally in our fields, and in nearly every instance they were found to be shoots from immature tops. These green immature joints were the parts of the cane usually thrown away in the tops, and contained only partially developed eyes—which early sent forth shoots—many of which perished during the drouth for want of sustenance which the joints did not contain, and which the dry weather prevented the young and very tender roots from absorbing from the earth. Whether these sprouts would have lived had a favorable season prevailed, or had the joints not been detached from the stalk, are questions at present, only of conjecture.

Barring the upper immature tops, our experiments clearly show that the upper portion of the stalk is the equal if not the superior of any other portion for seed, so far as germination, tonnage and available sugar are concerned. Experiment No. 3—the first full red joint gave the largest number of sprouts, matured canes, tonnage, and available sugar on the plat. The butts in No. 11 give by analyses the largest sugar content; how far this is due to the butts, *per se*, or to the interference of the tree is unknown. Tho experiments to be described further on also throw light on this interesting subject, and a recurrence to this question will then be made.

HOW MANY STALKS OF CANE TO PLANT?

Another question of equal importance to the one just discussed, was made the basis of a series of experiments during the past year. What number of stalks of cane shall we plant to secure the best results? This question is variously answered in practice; one to four stalks. If we plant in seven foot rows (the usual width) and use canes five feet long, weighing 2½ pounds each, there will be required to plant an acre, one

stalk and a good lap, about two tons of cane; two and a lap, 4 tons; three and a lap, 6 tons; and four and a lap, 8 tons. Cane was worth in Louisiana during the past season, from $3 to $5 per ton. If, therefore, it can be shown that one stalk and a lap or even two and a lap, furnish an abundance of seed, it is a serious loss of money to plant three and four.

WHICH IS BEST FOR SEED PLANT OR STUBBLE CANE.

Whether it is best to use plant or stubble cane for seed was combined with the above, so as to make the experiments answer both questions simultaneously. Accordingly a plat of ground one acre deep was laid off for the experiments, and divided perpendicular to its depths into two equal parts, the front was planted with, first year stubble, and the rear with plant cane, thus duplicating each one of the questions with both kinds of seed.

In the same platt were also tried a few experiments confirmatory of those already described, viz: What part of the cane is best for seed? Good canes were selected and cut first into two equal parts. the tops planted in one experiment and the butts in the next; and second into three equal parts, the tops given to one experiment, the middles to another, and the butts to a third.

There being ground enough left in this plat for another experiment, the following was tried, duplicated alike with plant and stubble seed: Unslaked lime at the rate of three tons per acre was spread evenly over the top of the row, after the cane was planted and covered, to see if the heat generated by the natural slaking of the lime would not induce early germination and ultimately to test the value of large applications of lime to our soils.

The following are the experiments in full:

No. 1—One cane with a lap, cut in the row.
" 2—Two canes with a lap, cut in the row.
" 3—Three canes with a lap, cut in the row.
" 4—Four canes with a lap, cut in the row.
" 5—One cane, no lap, uncut.
" 6—Upper halves of canes, two and a lap.
" 7—Lower halves of canes, two and a lap.
" 8—Upper thirds of canes, two and a lap.
" 9—Middle thirds of canes, two and a lap.
" 10—Lower thirds of canes, two and a lap.
" 11—Unslaked lime, three tons per acre.

These experiments were planted Feb. 10th, and the young plants carefully counted twice before suckering began. At harvest, each experiment was weighed, stalks counted, juice separately extracted and carefully analyzed. Tables 3 and 4 give the results.

TABLE 3.

PLAT O, GERMINATION QUESTIONS, GATHERED NOVEMBER 4, 1887.

Number and kind of Experiments.		March 13 No. of Sprouts.		May 25 No. of Sprouts.		November 4 Plant			November 4 Sttbble		
		Plant	Stubble	Plant	Stubble	No of Stalks	Weight of Stalks lbs	Tons per Acre	No of Stalks	Weight of Stalks lbs	Tons per Acre
1	1 cane (cut)........	.36	.50	.89	.77	371	1114	33.42	420	1109	33.27
2	2 " "	.87	.83	1.72	1.54	409	1232	36.96	413	1338	40.14
3	3 " "	1.36	1.44	2.20	2.14	430	1144	34.32	440	1336	40.08
4	4 " "	1.20	1.58	2.50	2.79	409	1296	38.88	479	1410	42.30
5	1 " uncut	.30	.48	.53	.77	357	1146	34.33	413	1132	33.96
6	Upper halves	1.08	1.06	1.48	1.54	421	1360	40.80	436	1292	38.76
7	Lower halves	.53	.57	1.23	1.09	388	1334	40.02	402	980	29.40*
8	Upper thirds.......	1.39	1.01	1.68	1.47	420	1278	38.34	344	918	27.54*
9	Middle thirds......	1.00	1.09	1.65	1.80	385	1276	38.28	310	860	25.80*
10	Lower thirds.......	1.17	.46	1.77	1.04	407	1134	34.02	296	740	22.20*
11	Unslaked lime......	1.14	1.03	1.65	1.55	396	1184	35.52	273	605	18.15*

*Injured more or less by shade of a live oak tree.

TABLE 4.

PLAT O—GERMINATION—QUESTIONS CONTINUED.

Number and kind of Experiment.	Yield per acre in tons	ANALYSES. Degree Baume.	Total Solids.	Sucrose.	Glucose.	Co-efficient Purity.	Glucose Ratio	lbs. available sugar upon 70 p. c. extrac. Per ton.	Per acre.
1 1 Cane cut, plant	33.42	7.05	12.71	9.9	1.77	77.89	17.87	101.5	3392.
1 1 " " stubble	33.27	7.3	13.24	11.3	1.57	85.35	13.88	125.30	4169.
2 2 " " plant	36.96	7.4	13.39	10.2	1.84	76.17	18.03	104.16	3850.
2 2 " " stubble	40.14	7.4	13.49	10.2	2.24	75.61	21.96	95.76	3844.
3 3 " " plant	34.32	7.3	13.19	10.1	1.92	76.57	19.00	101.08	3469.
3 3 " " stubble	40.08	7.5	13.69	10.3	1.90	75.23	18.44	104.30	4180.
4 4 " " plant	38.88	7.5	13.59	9.9	2 04	73.58	20.60	95.76	3723.
4 4 " " stubble	42.30	7.5	13.59	10.9	1.90	80.2	17.43	112.70	4767.
5 1 " uncut plant	34.33	7.3	13.24	10.8	1.90	81.57	17.59	111.30	3821.
5 1 " " stubble	33.95	7.4	13.49	10.4	2.00	77.83	19.23	103.60	3418.
6 Up'r halves plant	40.80	7.3	13.24	10.8	1.90	81.57	17.59	111.30	4541.
6 " " stubble	38.76	7.5	13.69	10.2	2 00	74.50	19.60	100.80	3907.
7 Lower " plant	40.02	7.3	13.19	10.8	2.14	81.88	19.51	106.26	4253.
7 " " stubble	29.40*	7.4	13.49	10.3	2.00	76.64	19.41	102 20	2004.
8 Up'r Thirds plant	38.34	7.3	13.14	10.4	1.90	79.90	18.26	105.70	4053.
8 " " stubble	27.54*	7.6	13.89	10.6	2.00	77.03	18.86	106.40	2930.
9 Middle " plant	38.28	7.4	13.44	10.5	1 90	78.12	18.09	107.10	4100.
9 " " stubble	25.80*	7.6	13.89	10.5	2.00	75.59	19.04	105.00	2709.
10 Lower " plant	34.02	7.6	12.74	10.0	1.86	78.49	18 60	101.00	3436.
10 " " stubble	22.20*	7.9	14.29	11.2	1.82	78.37	16.25	118.58	2521.
11 un'kd lime plant	35.52	8.4	15.24	12.4	1.40	81.36	11.29	144.20	5122.
11 ' " stubble	18.15*	8.3	15.09	12.9	1.74	85.42	13.48	144.05	2615.

*Injured by proximity of Live Oak.

The cane used in the above experiments was excellent, and the subsequent seasons were all that could be desired. The results secured may not be obtainable every season. However, these experiments strongly point to the conclusion that with good cane in well prepared soil and with good seasons, two canes and a lap furnish an abundance of seed, and the largest profits. This will be more plainly seen by deducting from the tonnage made, the tonnage required to plant as follows:

	Plant.			Stubble.		
	Tonnage made per Acre.	Tonnage planted.	Net Tonnage per Acre.	Tonnage made per Acre.	Tonnage planted.	Net Tonnage per Acre.
1 stalk...	33.42	2.00	31.42	33.27	2.00	31.27
2 stalk...	36.96	4.00	32.96	40.14	4.00	36.14
3 stalk...	34.32	6.00	28.32	40.08	6.00	34.08
4 stalk...	38.88	8.00	32.88	42.30	8.00	32.30

Here two stalks and a lap give the largest net yields both with plant and stubble, omitting entirely the expense and labor of handling the extra cane necessary in planting four stalks. True economy would therefore point to a concentration of energy in a careful preservation of seed, thorough preparation of soil, and planting not over two stalks and a lap.

It was a source of pleasure while growing to watch the contrast in the rapidity and number of suckers between the thinly and thickly planted experiments. One stalk grew and matured 282 suckers upon plant. and 343 upon stubble, against 159 and 191 respectively, with four stalks. The sugar content was about the same in each.

Another fact is noticeable in these experiments, viz: That the "one stalk uncut" has in both instances proven the equal of "one stalk cut."

These experiments show little or no difference in the yields from plant or stubble cane. In fact, contrary to expectation, where the experiments were not modified by the presence of trees, the stubble seed shows a slight superiority both in tonnage and sugar content.

An inspection of the tables will further confirm the experiments described elsewhere, that the upper part of the cane is as good if not better than any other portion for seed. Elsewhere will be found evidence of their inferiority in sugar to the lower portion of the cane. Theory would then suggest the utilization of the upper thirds of all of our cane as seed, and the lower two-thirds for the making of sugar. It is well known that at least one-fifth of the entire cane crop is now devoted to seed, an immense loss to the sugar planter. Cannot some feasible plan be adopted whereby the tops only shall be planted and the remainder so much richer in sugar, be sent to the mill?

The lime in the last experiment has given an increased sugar content and a larger amount of available sugar, without seriously effecting the tonnage. This is a suggestion well worth further investigation.

PHYSIOLOGICAL QUESTIONS.

Influence of Suckers.—A very great diversity of opinion prevails as to influence of suckers "side shoots," which spring up

around the base of the original sprout. This opinion has been based partly upon poorly conducted experiments, and partly upon the erroneous impression which this wrongly used term "sucker" has produced upon the mind. Some think it an abnormal growth, a live parasite preying upon the nutriment of the main stalk and thus depriving the latter temporarily of its vigor, at a time when rapid growth is so desirable, and therefore they should be removed. It has been found on the other hand however, that these suckers, if permitted to grow, reach maturity almost as soon as the parent stalk, is equally as large, and quite as rich in sugar. They also add largely to the crop, and when a thin stand is obtained, the multiplication of suckers rapidly closes the gaps and gives in the end fair yields. Some planters thus ascribe to suckers the greater part of their crop, and encourage their growth by awaiting for their full development in the spring before proceeding to a vigorous cultivation of their crop. They further claim that the suckers give stubble the next year, while the original or central stalks do not ratoon well, if at all.

All these discrepancies of opinion arise from a misunderstanding and misuse of the term "sucker." The habit usually denominated suckering in cane, is not suckering at all, but a process common to all graminaceous plants and known usually as "tillering." It is a natural means of increase and of preserving its own existence in the battle of life. By this means, grasses and small grains are enabled to occupy the entire ground to the exclusion et other plants, and thus secure increased harvests. This "tillering" is an underground development characteristic of cane and wheat, and springs from underground buds specially prepared for this process. Simultaneous with the development of the sucker is a set of roots of it own, springing directly from it and in no way interfering with the roots of the original plant. The extent of tillering or suckering depends therefore upon the healthy growth, the thickness of the stand, and the time it has to sucker in. Abundant tillering is an evidence of thriftiness and an index to increased root development The cane however truly "suckers" but fortunately such occurrences are rare. By true suckers, is meant, the development of

eyes above ground, which produce stalks living at the expense of the parent stalk. This occurs whenever the upward growth of the plant is checked, or the stalk is bent down from any cause, followed by very damp weather etc. This process is very common to some varieties of sorghum after its main stalk has reached maturity. It is also found in oats, which frequently send forth branches from the axils of leaves which bear grain. In both instances the seed unequally ripens. True suckers in cane are therefore very objectionable and should be prevented if possible.

The above from Bulletin No. 7, prefaces the results of attempting to "desucker" cane. The experiments therein given were so conclusive against any attempt to prevent cane from suckering that the following suggestions were offered which are here repeated.

From the above it is perfectly plain that the "tillering" [suckering] of cane is a natural process of great benefit, and should be restricted with great care. To what extent and when a too great a tendency to this process should be corrected is a question for the individual planter to decide. Cane planted too thick, in thin soils, in badly broken, or poorly tilled land, and very late in season, tiller but little. The tendency nevertheless exists, but root growth is checked and with it the prospects of a crop. Hence the aim should be to attain the healthiest and richest type of the plant, and such is to be found only when the conditions exist for its freest and fullest development of all its parts in a manner devised by nature. This suggests then, care in planting, not to secure too heavy a stand in the beginning for the fertility of the soil; proper manuring, in quantity, quality, and mode of application; deep plowing in the preparation of land, and early cultivation of crop, and shallow culture thereafter to prevent disturbance of increased root growth, early planting with well selected seed, and upon mellow well drained soil. A close attention to the above and the process of suckering can be encouraged with hope of highest results.

Whether the stubble comes only from the suckers, can be positively determined next year, since these plats will be reserved for that purpose.

These plats were preserved and watched through the sea son with considerable interest. The plat upon which no suckers were permitted to grow, presented a few stripped, straggling, scattered, sugarless stalks, long after the regular crop was harvested. These were cut down and thrown on the bagasse pile late in January. Early in February suckering began, and in a few weeks the best stand of cane on the Station was to be seen upon this plat. It seemed as if all the energies of the plant, restrained for an entire year by artificial processes, were suddenly let loose and concentrated upon suckering. So successfully did it accomplish its purpose, that a yield of over 30 tons per acre was obtained, yielding a juice containing 12.4 per cent of sugar.

It is therefore conclusively proven that stubble comes from the original stalks as well as from the suckers.

VARIETIES OF CANE.

In 1886 the Station received and planted what was thought to be 17 varieties of cane. Upon gathering and carefully comparing, these were reduced to five distinct varieties, which were again planted. Mention was made in our last report of the courteous request of Commissioner Coleman, at Washington, upon the U. S. Consuls in the various sugar growing countries, to send to this Station, samples of all obtainable varieties of sugar cane. This request has been liberally complied with and since last April this Station has received 55 samples of sugar cane from 10 different countries. The following is a complete list of the cane received.

FOREIGN VARIETIES RECEIVED.

Name of Cane.	By Whom Sent.	Where From	Received	Color.	Condition
1 Not given..	R O Williams	Havana	April 4	Green	Good
2 Not given..	"	"	"	Yellow	"
3 Not given..	"	"	"	Red	"
1 Cristallina stubble.....	Dr Alvaro Reynoso	"	" 22	White	Excellent
2 Cristallina plant.......	"	"	"	"	"
3 Blanca D'Otaite ...	"	"	"	"	"
4 Portie......	"	"	"	"	"
5 Louc[illegible]r	"	"	"	"	"
6 Bambu	"	"	"		
7 Caven[illegible]erie.	"	"	"	Red	
1 Plant cane.	W F Fuqua	Livingston Guatamala	May 23	Green	Dead
2 Stubble	"	"	"	"	"
1 Batavian...	U S Consul	Antigua	June 18	Striped	"
2 Bourbon ...	"	"	"	White	"
3 Caledonian Queen	"	"	"	Green	"
4 Batavian purple violet	"	"	"	Purple	"
1 Violet.....	"	Jamaica	July 2	"	"
2 Mont Blanc	"	"	"	White	"
3 Ribbon	"			"	"
1 Not given ..	"	St. Domingo	" 6	Green	"
1 Native Creole.........	"	Guadaloupe	July 13	Green	Fair
2 Batavian cane	"	"		Striped	"
3 Salanger ...	"	"			
1 White transparent	Moses H Sawyer	Trinidad		White	"
2 Green Rose Ribbon	"			Green	Poor
3 Otaheite (plants)	"	" "		Striped	"
4 Bourbon ...	"	"		White	"
5 Otaheite ratoons	"	"		Striped	Good
6 Congo	"	"			"
7 Giant scarlet	"	"			
8 Not named.	"	"		Red	
9 " "	"				
1 " "	Unknown				
2 " "	Steamship Baracouta to N Y &	Unknown	July 13		Dead
3 " "	forwarded by				
4 " "					
1 " "	Tice & Lynch	Port au			
2 " "	E W Thompson	Prince	Dec. 1887		"
3 " "	U S Consul	Hayti			"
1 Kanio	J H Putnam	Honolulu	Aug. 25	Light	Excellent
2 Amakea	"	"	"	Dark	"
3 Caledonia ..	"	"	"	Pale Yel.	"
4 Ottamatre..	"	"	"	Red	"
5 Rose bamboo	"	"	"	Pinkish	"
6 Elephant...	"	"	"	Pur. str'p	"
7 Uwala	"	"	"	Rose	"
8 Ohia	"	"	"	Red	"
9 Pupuha	"	"	"	Pinkish	"
10 Akilolo	"	"	"	G'n & pur	"
11 Manulete..	"	"	"	Purple	"
12 Honuaula .	"	"	"	Dark red	"
13 Papaa.....	"	"	"		"
14 Lahaina ...	"	"	"	Yellow	"
15 Not named.	"	"	"		"
19 Kokea	"	"	"		"

Some of these reached the Station in excellent order; Others in execrable condition, in fact every eye perfectly dead. However, of the 55 varieties shipped, 29 are living and ten have furnished seed for another year. The Station is under grateful obligations to Hon. T. F. Bayard, Secretary of State. Hon. N. J. Colman, Commissioner of Agriculture, Dr. Alvarez Reynoso of Cuba, the U. S. Consuls who have forwarded the cane, and the generous planters in the various countries who have furnished it. Out of this large number of varieties received, it is hoped that some may prove beneficial to the sugar industry of the State.

The following letters and extracts may be interesting to our readers:

COPY--TRANSLATION.

EXPERIMENTAL FIELD OF DR. ALVARO REYNOSO.

Ramon O. Williams, Esq., Havana:

My Dear Sir—In the desire to please you, I beg these remarks, informing you that I have complied with your request for the furnishing of the sugar canes, and then amplify them under the belief that you are desirous of the increase of the cultivation of that plant in Louisiana.

1st. Variety of canes cultivated in the Island of Cuba.

The only canes cultivated on a large scale are those of Otahaiti, known as the white and crystalline [blancay cristalina.]

The white cane is planted in virgin soil, and the crystalline in all other lands.

At first Creole cane, [cana criolla] was cultivated in Cuba to make sugar, and its planting was continued afterwards for eating. But for several years past it has not even been preserved for this purpose, and that now sold in the market for eating is the white cane of Otahaiti.

The purple and yellow ribbon canes [cana de cintas morada y amarilla] were formerly much cultivated here, but were afterwards abandoned because it was discovered that in dry and not very fertile lands they yielded little juice and were very woody. Nevertheless, these canes when well cultivated are of excellent qualities. Green ribbon cane of the same variety was also cultivated but it was abandoned on account of being too delicate.

Many varieties of cane have been introduced in Cuba from Porto Rico, Jamaica, Trinidad and Mauritius, but of these little remain, none of them having been cultivated on a large scale. The elephant cane [cana elefante] was somewhat cultivated but afterwards abandoned because of its brittleness, and not ripen-

ing well, being besides too thick to grind it with regularity in the sugar mill. Many persons have uprooted it.

The crystalline cane in its normal state is of a green apple color, but gives many varieties according to soil, exposure, methods of cultivation or atmospheric influences. The most notable variations in this cane are that of acquiring a peculiar yellow color in certain soils which makes it resemble the white cane of Otahaiti; and another variation is that taking a more or less purple color which makes it resemble other canes of different colors or shades, above all that of the purple ribbon cane [cana de cinta morada]. Nevertheless those canes, notwithstanding their variations recover their genuine original character if planted in proper lands. The number of different varieties of cane supposed to, do not exist; but their variations are numerous.

I send you, marked A three crystalline canes the ends of which have been dipped in heated wax. This cane is the result of an experiment which I will further describe in treating of the multiplication of canes through their subterranean shoots, [rattoons].

B Are three white canes of Otahaiti whose ends are also covered with melted wax.

I would have desired to have been able to send you better samples; but the canes I have, are not yet well matured. It will be easy for me further on to furnish you beautiful samples of cane cultivated in cleared forest soil:

So far your request has been complied with, and I will now make a few remarks:

2nd. Cane tho most fitter for cultivation in Louisiana.

The canes that I consider best for this purpose, owing to their great precocity for rattooning, are those called "Cavengerie", Portii, "Loncier", "Bambu" and "Black cane from Java" [Negra de Java]. I do not send the latter because I know it exists in great quantity in Louisiana and that it is being experimented upon.

A. The "Cavengerie" comes from Mauritius; it grows rapidly, rattoons, and matures extremely well. In order that this cane may be fully oppreciated, I will say that I cut thirty canes, leaving numerous rattoons. From these thirty canes I separated three useless ones, and the other 27 are put up in a package well prepared. It will be noticed that these canes have grown from one only eye [una sola yema] which was put in the ground on the 1st of October, 1885. I ought to have cut these canes in the month of November or December, of the year 1886, because they were already completely mature, and they have lost in quality and growth by leaving them standing too long. The 27 canes mentioned weigh 186 pounds.

B. Is "Portii" cane from the Mauritius Island; it was highly praised by the manager of the botanical garden when he sent it here. In effect it is an admirable cane. It grows rap-

idly, rattoons well and its juice weighs more than 12° Baume. One bunch grown from a single root gave me 28 beautiful canes, weighing 233 pounds. I have here to state, as before, that I should have have cut these canes in December of last year but having left them standing they have lost much of their merit on account of having shed their upper sprouts. This bunch of canes was also produced from one single root. Of these I send you 5 canes weighing 59 pounds.

C. Is the "Loucier" cane from Mauritius, and possesses the same excellent qualities.

This bunch gave me 34 canes. weighing 188 pounds. I should have cut it last year. Of these I send 5 canes weighing 41 pounds.

D. Is the "Bambu" cane. It came from Mauritius. In my opinion this cane grows and rattoons faster than any other. Nevertheless, I do not dare to give it preference over the others above mentioned, until after it shall have been experimented upon for the reason that its shoots are much developed forming many upper sprouts which tend to diminish the yield of sugar, at least for some time

You have observed the difficult conditions under which I experiment, and you will readily understand that under better circumstances the results would have been extremely more favorable.

Should it be determined to experiment upon these varieties in Louisiana, I can send you a quantity of them, particularly in January of next year, to plant there.

3D. MULTIPLICATION OF CANES THROUGH THEIR SUBTERRANEAN ROOTS.

This matter is treated of in a general manner in the three numbers of the "Journal des Fabricants de Sucre" which accompany herewith. The French translation is not altogether correct, but is sufficiently so to give a fair understanding of the importance of this subject.

All the experiments which I have made confirm, in the most positive manner. the merit of subterranean roots over the eyes of the cuttings taken from the upper part of the cane. In other words the subterranean stalk as a multiplier is as good as the very best eyes that can be obtained. One single experiment will suffice to prove this. On Thursday. the 25th of February, 1886, I washed a crystalline cane well in water to clean off the earth and then cut the small roots with a pair of scissors. I then separated the roots dividing them into small pieces having only one root, and planted them.

On Monday, the 22d of March, of the same yenr, I took up one shoot from the plantings and put it into the best place I could find.

I did not expect to obtain a very favorable result, because the conditions under which I operate are by no means favorable, having been obliged to proceed in an incorrect manner. I was pleased, however, to a certain extent, because its resnlts were better than could have been expected, under such unfavorable conditions.

On Tuesday, the 12th of April, 1887, I cut all the shoots on a level with the ground and obtained:

1 More or less developed canes	22
2 Sprouts of different sizes	21
3 Small sprouts	6
4 Canes damaged by accident	5
Total	54

The above mentioned 22 canes weighed 112 pounds.

After cutting off the bunch of canes I pulled up the stock of roots, leaving the earth around them, and placed into the box in which I send it to you for forwarding it to Louisiana.

As soon as this box arrives at New Orleans, and in order to study and appreciate tha foregoing statements it will be necessary to take this stock of roots out of the box and remove all the earth from it with any sharp instrument and put it into water. The roots should be cut off so as to permit of an examination of each of the subterranean stalks and the condition of the roots.

This examination will completely prove that it suffices to plant one subterranean stalk to obtain an excellent bunch of canes equal to the hest to be obtained by planting the most select upper eyes.

After experiments shall have been made of the foregoing method I would desire that a complete statement of the same be sent me and, if possible, also photographs to add to my collection of observations, in order, thus to complete the history of this trial, which I consider very important, in every respect, and which has only now been made for the first time.

After all this has been done the subterranean roots may be separated the one from the other, and planted.

I will finish, by saying that this experiment has been made under unfavorable auspices for the development of the stalks, and if I had had a better opportunity for operation the result would have been far superior respecting the growth and weight of the cane. However, the fact of having obtained 112 pounds

of cane from one root alone, at this season of vegetation, is satisfactory enough.

I would have desired, Mr. Williams, to have been able to serve you better in this matter, but trust, however, that I have manifested my good will to attend to it. Shonld you desire further details respecting the cultivation of cane and the manufacture of sugar I shall take great pleasure in furnishing them.

I have the honor to be,

Your obedient servant,

DR. ALVARO REYNOSO.

Havana, April 14, 1837, Cabzada de Buenos Ayres No. 11.

The above letter was not received until after the stubble mentioned above had been planted in the usual way; too late to be disturbed.

Extract from a letter from U. S. Counsel Moses H. Sawyer, Trinidad B. W. Indies:

"They are numbered and named as follows:

No. 1—3 canes, Otaheite, plant.
" 2—3 canes, Otaheite, ratoon.
" 3—3 canes, White Transparent, ratoon.
" 4—3 canes, Green Rose Ribbon, plant.
" 5—3 canes, Red Giant Scarlet, plant.
" 6—3 canes, Congo, plant.
" 7—2 canes, Bourbon, plant.

"There are six varieties, and none others are generally planted on this Island. Of all the many kinds that have been tried none others have done well and only two of these are generally planted. Otaheite is the king cane of this Island and Bourbon comes next. Indeed they are much alike.

"Planters generally plough up for Otaheite once in 10 or 12 years. but in good soil this extraordinary cane has rattooned here successfully for 23 years. The Transparent, Giant Scarlet and Congo, are hardy, and the Rose Ribbon grows straight up which entice the planter to plant them in some quarters; but the great cane fields of Trinidad are mostly covered with Otaheite and Bourbon. It should be remembered that Trinidad is drenched in profuse rains for two-thirds of the year, making the soil very wet, which is not the case in Louisiana; so that the canes that do so well in Trinidad might not do well in Louisiana, or vice versa."

The following letter to Consul J. H. Putnam, from Mr. W. G. Irwin, of Spreckles Co., who undertook the task of collection describes the varieties sent:

HONOLULU, H. I., Aug. I, 1887.

Sir—In accordance with your request we have obtained from one of our plantations, thirteen varieties of sugar cane. The canes are carefully packed and will go forward per steam-ship Australia, to morrow.

The package labelled No. 12 contains four varieties of cane imported by us, from Queensland, Australia, viz:

Ottamatie, red with faint dark stripes.
Rose Bamboo, pinkish yellow.
Yellow Caledonia, pale yellow.
Elephant, purple with pale green stripes.

These four canes do very well with us, more especially the first mentioned. The canes labelled Pupuha, Manulele, Uwala, Ohia, Akilolo, Honuaula and Papaa are indigenous to these Islands. These canes, on lands situated at any altitude between 1,500 and 2,000 feet, are, from the fact of their being exceedingly hardy, the favorite varieties of our planters for such lands. The two packages labelled respectively, Kanio and Ainakea, came originally from Mauritius, where they are as the light and dark Bourbon canes. These two canes yield well on our high lands. Lahaina cane, No. 11, was brought here by Capt. Pardon Edwards, from the Marquesas Islands; and was first planted at Lahaina, whence its name. This cane is preferable to all others on lands near the sea level to an altitude of 1,500 feet. Its introduction into this Kingdom has increased the yield of sugar, at least 50 per cent. In consequence of its heavy stooling, this cane should be planted not less than six feet between the hills. Kokea, No. 13, does fairly well on side hills and dry lands, but is not a favorite.

We are sir,
Yours truly,
WM. G. IRWIN & CO.

To J. H. Putnam, U. S. Consul Gen'l., Honolulu, H. I.

Besides the above foreign varieties, the Station also received the following:

One hogshead of cane from Mr. Raphael Beltran, New Orleans.

One bundle of cane from Mr. H. Le Sassier, New Orleans.

One bundle of cane from Hon. L. B. Claiborne, Pointe Coupee, La.

One bundle of Creole cane from Mr. R. L. Perkins, Jefferson, La.

The following analyses were made of such samples as attained before frost a size large enough to justify planting. The samples from Cuba were planted in April and attained a very fine size by Nov, 14, at which time they were cut. The Cavengerie particularly, gives promise of a fine yield, and special adaptation to our soil and climate, so far as growth is concerned, but is rather low in sugar. The Crystallina and Loucier which are the highest in sugar, did not reach a large tonnage.

TARLE 5.

PLAT I—VARIETIES—HARVESTED NOVEMBER 14.

No. of Experiment.	Where From.	Kind.	When Planted.	Analysis Oct. 27. Degrees Baume.	Analysis Oct. 27. Total Solids.	Analysis Oct. 27. Sucrose.	Analysis Nov. 14. Degree Baume.	Analysis Nov. 14. Total Solids.	Analysis Nov. 14. Sucrose.	Analysis Nov. 14. Glucose.	Purity Coefficient.	Glucose Ratio.	Pounds available sugar per ton upon 70 per cent extraction.
1	Selected Gen. J. L. Brent	Purple	Nov. 22	8.5	15.39	13.00	8.65	15.60	14.20	1.05	91.05	7.39	190.82
2	Selected, Dr. Wm. E. Brickell	"	" "	8.8	15.89	14.50	8.8	15.90	14.49	.93	90.50	6.11	185.64
3	Mex can, Gen. J. L. Brent	Striped	" "	8.7	15.69	13.30	7.8	14.19	11.00	.94	77.51	9.33	133.84
4	La Pice, Gen. J. L. Brent	White	" "	7.9	14.29	11.30	9.0	16.24	13.50	1.11	83.12	8.22	165.76
5	Bourbon (Cuba) from D. D. Colcock, Sugar Ex.	"	" "	8.4	15.09	13.20	9.0	16.24	14.10	1.03	86.82	7.30	175.56
6	Beltran, from Raphael Beltran	Yellowish	March 3	7.4	13.29	10.20	8.4	15.13	13.20	1.28	87.24	9.84	157.92
7	Crystallina, stubble	White.	April 22	8.0	14.39	11.40	8.5	15.37	11.60	1.20	75.47	10.34	137.20
8	Crystallina, plant	"	" "	6.9	12.39	7.80	8.2	14.87	11.40	1.67	76.66	14.64	123.90
9	Blanca D'Otaiti	"	" "	7.4	13.29	9.30	8.0	14.47	10.30	1.55	71.17	15.04	101.72
10	Portii	"	" "	6.7	12.09	6.30	7.9	14.37	11.80	1.33	82.11	11.27	137.36
11	Loucier	"	" "	7.2	12.89	8.50	7.3	13.27	8.90	1.64	67.06	18.42	89.16
12	Bambu	"	" "	6.8	12.29	8.90	7.4	13.47	9.80	1.85	73.49	18.87	98.42
13	Cavengerie	Red	" "	6.3	11.39	6.10	6.8	12.27	7.20	1.72	58.67	23.88	64.68
14	U. S. Consul to Cuba	"	April 4	6.2	11.09	5.50							
15	" "	Green	" 4	6.3	11.34	6.30	6.4	11.64	7.30	1.60	62.71	21.81	68.60
16	" "	Grn'sh red	" 4	7.7	13.87	9.00							
17	" "	White	" 4	6.9	12.47	8.40							
18	" "	Yellow	" 4	6.2	11.17	5.50	6.6	11.94	7.10	1.67	59.44	23.52	64.40
19	Hon. L. B. Claiborne	White	March 1	7.8	13.97	9.90	7.9	14.32	12.00	1.08	83.79	9.00	145.32
20	Creole, R. L. Perkins	Green	" 1	6.3	11.29	6.90	6.1	11.08	5.60	1.72	50.54	30.71	42.28
21	Panache H. LeSassier	White					8.3	15.09	12.50	1.21	82.83	9.68	149.66
22	Dr. Brickell	Striped					7.8	14.09	11.50	1.32	81.61	11.40	133.28

MANURIAL REQUIREMENTS.

It is desired to find a fertilizer that will give a maximum tonnage with a maximum sugar content with cane upon the soils of Loulsiana. The Station continued last summer its work upon the soils of lower Louisiana. It has already made analyses of sixty-six samples from 18 parishes. In a few years, after a full investigation, it is designed to classify the soils of the sugar belt, and to designate the fertilizers adapted to each class.

Unfortunately there is no sandy soil on this Station. Beginning at the levee, the soil is a mixture of sandy and black, the latter largely predominating. It shades gradually into stiff black lands as you recede from the river. These analyses of of the soil of this Station, taken at different distances from the river, are here appended:

ANALYSES OF SOILS OF SUGAR EXPERIMENT STATION.

	Plat No. 16—Next to River—Mixed Soil	Plat No 2—Group 1—200 yd's from River—Bl'k Soil	Plat No. 2—Group 7—400 y'ds from River—Bl'k Soil
Insoluble Matter	79.37	77.52	74.21
Soluble Silica	.01	.01	.01
Potash	.31	.20	.13
Soda	.48	.19	.23
Lime	.46	.57	.52
Magnesia	.04	.03	.03
Peroxide of Iron—Alumina	6.37	6.74	6.63
Phosphoric Acid	.12	.11	.10
Sulphuric Acid	.04	.04	.03
Organic Matter	10.50	14.50	16.24
Carbonic Acid—Chlorine and Loss	2.30	.09	1.87
	100.00	100.00	100.00

An examination of above shows that so far as the mineral ingredients are concerned, that these soils are almost identical. The organic matter increases as we go from the river. These soils are deficient in physical qualities rather than chemical ingredients. The former limiting the available supply of the latter, and requiring the application of manures for large crops. To test the kinds and quantities required, has been the object of

the series of experiments which follow. It should be remembered that any physical amendment to a soil, such as underdraining, deep plowing, subsoiling, etc., is in itself a manure, since it enables the roots of a plant to forage over an increased area and thus obtain larger supplies of available food.

The Station had 7 plats devoted to manurial requirements, three of which may be designated as strictly scientific, and the rest as popular. The three scientific plats were devoted, 1st, to Nitrogenous; 2d, to Phosphoric Acid; 3d, to Potassic manures.

The objects of these plats are:

1. To tell the requirements of these soils for each ingredient.

2. To tell the form best adapted to cane.

3. To tell the quantity most profitable for cane.

Accordingly all the available forms of these ingredients have been used in varying quantities. To test the requirements of a soil for any particular ingredient, every other ingredient must be present in excess. Hence each particular ingredient tested has been combined with an excess of other ingredients. The first ground was—

PLAT VI—Nitrogen Manures

first year stubble; off-barred March 5th, with 4-horse plow; hoed April 1st; manures applied and middles broken out; subsequent cultivation with disk cultivator; laid by with 4-horse plow.

The "nothing" experiments were given the centre of the plat, an advantageous position in every instance, especially in black lands, but no better arrangements could be made, and it was preferable to err in favor of no manure, rather than in the fertilizer used.

The object of this plot was: 1st, to test the requirements of this soil for nitrogen; 2d, the form of nitrogen best adapted for cane; 3d, the quantity of nitrogen most desirable.

Accordingly all the available forms of nitrogen have been used, both alone and in combination with phosphoric acid and potash. A full ration of nitrogen has been taken at 72 lbs. to the acre, and it has been furnished under each form in such

quantities as to give 24, 48 and 72 lbs. to the acre, or one-third, two-thirds and three-thirds rations. The plat was four acres deep, the soil increasing in tenacity and stiffness from the front. All of it was black land. It was divided into eight groups of five experiments each, the former running across and the latter with the plat. Each group consisted of: First, an experiment with the normal amounts of phosphoric acid and potash (mixed minerals) without nitrogen; second, of an experiment with no manure; third, fourth and fifth, of mixed minerals, with one-third, two-thirds and three-thirds rations respectively of nitrogen.

In the above "mixed minerals" means always 450 lbs. acid phosphate and 120 lbs. muriate potash.

Results are appended.

Results are appended. A diagram of the plat with manures used, yield of cane, analyses and available sugar, is also given.

TABLE 6.

RESULTS OF PLAT NO. 6—NITROGENOUS MANURES—STUBBLE CANE.

No. of Exp't	Manures Used Per Acre.	Yield per Acre in Tons	Analyses. Degrees Baume.	Analyses. Total Solids	Analyses. Sucrose.	Analyses. Glucose	Purity Coefficient.	Glucose Ratio.	lbs available sugar upon 70 p c extraction Per ton	lbs available sugar upon 70 p c extraction Per acre	When Harvested	Remarks.
1	150 lbs Nitrate of Soda	28.21	7.1°	12.80	9.00	2.30	70.30	25.50	77.7	2192	Oct. 4	
2	112½ lbs. Sulphate of Ammonia	28.14	6.6	11.90	9.00	2.27	75.60	25.20	78.5	2209	"	
3	No manure	20.44	7.2	13.00	10.10	2.20	77.70	21.70	95.2	1946	"	Forms of Nitrogen alone
4	225 lbs. Dried Blood	22.82	7.3	13.20	10.20	2.15	77.30	21.00	97.6	2228	"	
5	360 lbs. Cotton Seed Meal	19.81	6.9	12.50	9.00	2.40	72.00	26.60	75.6	1498	" 5	
6	300 lbs. Acid Phosphate, 120 lbs Muriate of Potash, mixed minerals	20.16	7.3	13.20	9.90	2.35	75.00	23.70	89.2	1798	"	
7	Mixed Minerals, 150 lbs. Nitrat Soda	27.40	7.4	13.40	10.60	2.00	79.00	19.00	106.4	2913	"	
8	No manure	18.00	7.3	13.20	9.60	2.50	72.70	26.00	81.0	1474	"	Nitrate of Soda Group
9	Mixed Minerals, 300 lbs. Nitrate Soda	21.77	6.8	12.30	8.80	2.42	71.50	27.50	72.4	1576	" 6	
10	Mixed Minerals, 450 lbs. Nitrate Soda	26.50	7.4	13.40	10.10	2.15	75.30	21.20	96.2	2550	"	
11	Mixed Minerals	16.72	7.5	13.60	11.40	2.00	83.80	17.50	117.6	1967	"	
12	Mixed Minerals, 112½ lbs. Sulphate of Ammonia	21.31	7.6	13.70	11.60	1.85	84.67	15.80	123.5	2633	"	
13	Fo manure	15.22	7.2	13.00	10.80	1.80	83.88	16.60	113.4	1726	"	Sulphate of Ammonia Group
14	Mixed Minerals, 225 lbs. Sulphate of Ammonia	29.00	7.2	13.00	10.40	2.00	80.00	19.23	103.6	3004	" 7	
15	Mixed Minerals, 337½ lbs. Sulphate of Ammonia	27.16	6.8	12.30	9.60	2.15	78.05	22.39	89.25	2442	"	
16	Mixed Minerals	16.00	7.3	13.20	11.00	1.95	83.33	17.72	113.05	1809	"	
17	Mixed Minerals, 225 lbs. Dried Blood	26.00	7.6	13.70	11.50	1.80	83.21	15.65	123.20	3203	"	
18	No manure	17.46	7.3	13.20	11.00	1.90	83.33	17.27	114.10	1992	"	Dried Blood Group.
19	Mixed Minerals, 450 lbs. Dried Blood	26.84	6.9	12.50	10.40	1.60	83.20	15.38	112.00	3006	"	
20	Mixed Minerals, 675 lbs. Dried Blood	15.20	6.8	12.30	9.00	2.32	73.17	25.78	75.88	1912	"	

21	Mixed Minerals	13.19	7.8	14.00	11.10	1.80	79.28	16.21	117.60	1552	" 10	Cotton Seed Meal Group.
22	Mixed Minerals 360 lbs. Cotton Seed Meal	19.18	8.15	14.60	12.20	1.45	83.90	11.88	140.30	2695	"	
23	No manure	15.57	7.9	14.30	12.00	1.66	83.91	13.83	133.20	2074	"	
24	Mixed Minerals 720 lbs. Cotton Seed Meal	22.40	7.6	13.70	11.6	1.82	84.67	15.68	124.10	2780	"	
25	Mixed Minerals 1080 lbs Cotton Seed Meal	22.36	7.5	13.60	10.90	2.00	80.14	18.35	110.60	2473	"	
26	Mixed Minerals	12.40	8.2	14.80	12.2	1.56	82.43	12.79	138.	1719	" 12	Fish Scrap Group.
27	Mixed Minerals 300 lbs. Fish Scrap	17.70	8.6	15.50	13.1	1.11	84.51	8.47	160.	2816	"	
28	No manure	12.77	8.2	14.80	12.4	1.60	83.78	12.90	140.	1788	"	
29	Mixed Minerals 600 lbs. Fish Scrap	20.33	8.1	14.60	12.7	1.56	87.00	12.28	145.	2948	"	
30	Mixed Minerals 900 lbs. Fish Scrap	22.70	7.8	14.00	11.5	1.66	82.14	14.43	126.2	2865	"	
31	Mixed Minerals	13.12	8.2	14.80	12.5	1.35	84.46	10.80	146.6	1920	" 13	Mixed Nitrogen Gr'p
32	Mixed Minerals 50 lbs. Nitrate Soda 40 lbs. Sulphate Ammonia 120 lbs. Cotton Seed Meal	16.69	8.5	15.30	12.9	1.25	84.31	9.69	154.3	2575	"	
33	No manure	12.71	8.1	14.60	12.3	1.46	84.24	11.87	141.5	1798	"	
34	Mixed Minerals 100 lbs. Nitrate Soda 80 lbs. Sulphate Ammonia 240 lbs. Cotton Seed Meal	18.60	8.2	14.80	12.3	1.50	83.11	12.20	140.7	2621	"	
35	Mixed Minerals 150 lbs. Nitrate Soda 120 lbs. Sulphate Ammonia 360 lbs. Cotton Seed Meal	24.60	8.0	14.50	11.7	1.56	80.69	13.34	131.0	3235	"	
36	200 lbs. Fish Scrap	12.60	8.4	15.10	12.3	1.80	81.46	14.63	134.4	1693	"	Forms of Nitrogen Alone.
37	200 lbs. Fish Scrap	18.21	8.4	15.10	12.1	1.66	80.13	13.72	134.5	2450	"	
38	Nothing	13.33	8.5	15.30	12.6	1.84	82.36	14.60	137.7	1835	"	
39	210 lbs. Mixed Nitrogen	14.70	8.5	15.30	12.8	1.50	83.66	11.72	147.7	2171	"	
40	210 lbs. Mixed Nitrogen	17.01	8.3	15.00	12.1	1.84	80.67	15.21	130.7	2223	"	

PLAT No 6.—Forms of Nitrogen.

FRONT.

NAMES.						
Forms of Nitrogen alone.	(1)	(2)	(3)	(4)	(5)	No. of Experiment.
	Nitrate Soda.	Sulphate of Ammonia	Nothing.	Dried Blood.	Cot. Seed Meal.	Manures per acre.
	28.21	28.14	20.44	22.82	19.81	Yield in tons per acre.
	12.80	11.90	13.00	13.20	12.50	Total Solids.
	9.00	9.00	10.10	10.20	9.00	Sucrose.
	2.30	2.27	2.20	2.15	2.40	Glucose.
	2192 lbs.	2209 lbs.	1946 lbs.	2228 lbs.	1498 lbs.	Available Sugar per acre.
Nitrate of Soda Group	(6)	(7)	(8)	(9)	(10)	No. of Experiment.
	Mixed Minerals	Mixed Minerals Nitrate Soda ⅓	Nothing.	Mixed Minerals Nitrate Soda ⅔	Mixed Minerals Nitrate Soda 3-3	Manures per acre.
	20.16	27.40	18.00	21.77	26.50	Yield in tons per acre.
	13.20	13.40	13.20	12.30	13.40	Total Solids.
	9.90	10.60	9.60	8.80	10.10	Sucrose.
	2.35	2.00	2.50	2.42	2.15	Glucose.
	1798 lbs.	2913 lbs.	1474 lbs.	1576 lbs.	2550 lbs.	Available sugar per acre.
Sulphate of Ammonia Group.	(11)	(12)	(13)	(14)	(15)	No. of Experiment.
	Mixed Minerals	Mixed Minerals Sul. Ammonia ⅓	Nothing	Mixed Minerals Sul. Ammonia ⅔	Mixed Minerals Sul. Ammon. 3-3	Manures per acre.
	16.72	21.31	15.22	29.00	27.16	Yield in tons.
	13.60	13.70	13.00	13.00	12.30	Total Solids.
	11.40	11.60	10.80	10.40	9.60	Sucrose.
	2.80	1.85	1.80	2.00	2.15	Glucose.
	1967 lbs.	2633 lbs.	1726 lbs.	3004 lbs.	2442 lbs.	Available sugar per acre.
Dried Blood Group.	(16)	(17)	(18)	(19)	(20)	No. of Experiment.
	Mixed Minerals	Mixed Minerals Dried Blood ⅓	Nothing	Mixed Minerals Dried Blood ⅔	Mixed Minerals Dried Blood 3-3	Manures used per acre.
	16.00	26.00	17.46	26.84	25.20	Yield in tons per acre.
	13.20	13.70	13.20	12.50	12.30	Total Solids.
	11.00	11.50	11.00	10.40	9.00	Sucrose.
	1.95	1.80	1.90	1.60	2.32	Glucose.
	1809 lbs.	3203 lbs.	1992 lbs.	3006 lbs.	1912 lbs.	Available sugar per acre.
Cotton Meal Group.	(21)	(22)	(23)	(24)	(25)	No. of Experiment.
	Mixed Minerals	Mixed Minerals Cotton Meal ⅓	Nothing.	Mixed Minerals Cotton Meal ⅔	Mixed Minerals Cotton Meal 3-3	Manures used per acre.
	13.19	19.18	15.57	22.40	22.36	Yield in tons per acre.
	14.00	14.60	14.30	13.70	13.60	Total Solids.
	11.10	12.20	12.00	11.60	10.90	Sucrose.
	1.80	1.45	1.66	1.82	2.00	Glucose.
	1552 lbs.	2695 lbs.	2074 lbs.	2780 lbs.	2473 lbs.	Available sugar per acre.
Fish Scrap Group.	(26)	(27)	(28)	(29)	(30)	No. of Experiment.
	Mixed Minerals	Mixed Minerals Fish Scrap ⅓	Nothing.	Mixed Minerals Fish Scrap ⅔	Mixed Minerals Fish Scrap 3-3	Manures per acre.
	12.40	17.70	12.77	20.33	22.70	Yield in tons.
	14.80	15.50	14.80	14.60	14.00	Total Solids.
	12.20	13.10	12.40	12.70	11.50	Sucrose.
	1.56	1.11	1.60	1.56	1.66	Glucose.
	1719 lbs.	2816 lbs.	1788 lbs.	2948 lbs.	2865 lbs.	Available sugar.
Mixed Nitrogen Group.	(31)	(32)	(33)	(34)	(35)	No. of Experiment.
	Mixed Minerals	Mixed Minerals m'd Nitrogen ⅓	Nothing.	Mixed Minerals m'd Nitrogen ⅔	Mixed Minerals m'd Nitrog'n 3-3	Manures per acre.
	13.12	16.69	12.71	18.60	24.60	Tons per acre.
	14.80	15.30	14.60	14.80	14.50	Total Solids.
	12.50	12.90	12.30	12.30	11.70	Sucrose.
	1.35	1.25	1.46	1.50	1.56	Glucose.
	1920 lbs.	2575 lbs.	1798 lbs.	2621 lbs.	3235 lbs.	Available sugar per acre.
Forms Nitrogen alone.	(36)	(37)	(38)	(39)	(40)	No. of Experiment
	Fish Scrap ⅓	Fish Scrap ⅓	Nothing.	Mx'd Nitrog'n ⅓	Mx'd Nitrog'n ⅓	Manures per acre.
	12.60	18.21	13.33	14.70	17.01	Tons per acre.
	15.10	15.10	15.30	15.30	15.00	Total Solids.
	12.30	12.10	12.60	12.80	12.10	Sucrose.
	1.80	1.60	1.84	1.50	1.84	Glucose.
	1663 lbs.	2450 lbs.	1835 lbs.	2171 lbs.	2223 lbs.	Available sugar per acre.

REAR.

Comparison of results will answer the three questions asked.

1st. Does this soil need Nitrogen?

Taking the plat as a whole we find the following averages:

	Yield per acre in tons.	Sucrose.	Glucose.	lbs available sugar per acre upon 70 p c extraction.
No manure	15.62	11.35	1.81	1828
Mixed minerals	15.27	11.30	1.83	1794
Nitrogen alone	20.17	10.80	1.99	2088
Mixed minerals with $\frac{1}{3}$ Nitrogen	21.37	12.00	1.57	2806
Mixed m.nerals with $\frac{2}{3}$ Nitrogen	23.13	11.30	1.81	2656
Mixed minerals with 3-3 Nitro.	24.76	10.40	1.97	2579
Excess of Nitrogen alone over				
No manure	4.55			255
Mixed minerals	4.90			289
Excess of mixed minerals with $\frac{1}{3}$ Nitrogen over				
No manure	5.75			978
Mixed minerals	6.10			1012
Nitrogen alone	1.20			723
Excess of Mixed minerals with $\frac{2}{3}$ Nitrogen over				
No manure	7.51			828
Mixed minerals	7.86			862
Nitrogen alone	2.96			573
Excess of mixed minerals with 3-3 Nitrogen over				
No manure	9.14			751
Mixed minerals	9.49			785
Nitrogen alone	4.59			496

Both Nitrogen alone and combined with mixed minerals have increased the tonnage and available sugar, the largest increase coming from Nitrogen combined with mixed minerals.

The 2nd question must be answered by comparing each group with its own "nothing" and "mixed minerals." By taking the mean of the three experiments of nitrogen in each group and

subtracting from it first the "nothing" and then the "mixed minerals," and comparing results, we have the following:

	Tons per acre.	lbs. available sugar per acre 70 per cent extraction.
Excess of mixed minerals with nitrate soda over—		
Nothing	7.23	872
Mixed minerals	5.02	548
Excess of mixed minerals with sulphate of ammonia over—		
Nothing	10.56	967
Mixed minerals	9.06	726
Excess of mixed minerals with dried blood over—		
Nothing	8.57	715
Mixed minerals	10.04	898
Excess of mixed minerals with cotton seed meal over—		
Nothing	5.74	620
Mixed minerals	8.12	1142
Excess of mixed minerals with fish scrap over—		
Nothing	7.50	1088
Mixed minerals	7.81	1157
Excess of mixed minerals with mixed nitrogen over–		
Nothing	7.11	1011
Mixed minerals	6.69	889
Average of above increases over—		
Nothing	7.78	879
Mixed minerals	7.79	893

It is evident from above that no form of nitrogen on this soil has any great advantage over another either in increased tonnage or available sugar. It is also evident that phosphatic manures without nitrogen are of no avail, and that to produce the best effects both phosphates and nitrogen must be present.

3d—The quantity of nitrogen most desirable per acre has been incidentally answered under our first question, treating the plat as a whole.

We then found that the tonnage was larger with heavier doses of nitrogen, but the available sugar per acre was less. Recapitulating we have the average as follows:

	Tons per acre.	lbs. available sugar per acre 70 per cent extractiod.
Average of 1-3 rations	21.37	2773
Average of 2-3 rations	23.14	2656*
Average of 3-3 rations	24.76	2579

Each group taken separately will show but slightly different results. The one-third ration shows largest sugar yield in the nitrate soda and dried blood groups; the two-thirds ration in sulphate ammonia, cotton seed meal and fish scrap; the three-thirds ration in mixed nitrogen. The last however, shows but a slightly increased quantity over the one-third ration.

Seasons have much to do with results, and only by the elimination of their influence through a series of years can positive deductions be made from field experiments. However, this plat with a good stand and fair season, suggests strongly the following conclusions:

1. That our soil needs nitrogen badly, and that the best effects are produced when it is mixed with phosphoric acid.

2. That no particular form of nitrogen has a decided advantage over others—a conclusion most gratifying, since it permits us to use our own cotton seed meal, instead of some of the more costly imported forms of nitrogen.

3. That excessive quantities of nitrogen are not productive of the best results—24 to 48 pounds equivalent to 400 to 700 pounds of cotton seed meal per acre are the limits, suggested by these experiments of maximum sugar production—when properly combined with mineral manures.

*Leaving out the nitrate of soda which was unaccountably low we have as average of the rest 2872.

PHOSPHORIC ACID MANURES—PLAT 7—STUBBLE CANE.

The object of this plat is to test the form and quantity of phosphoric acid best adapted to cane; using it in a soluble form in dissolved bone black and acid phosphate, in a precipitated form as precipitated bone black and precipitated acid phosphate, and in an insoluble form as bone dust and finely ground Charleston phosphate, called "floats"; also in the natural form of Orchilla guano. Each used in 1-3, 2-3 and 3-3 rations. Off barred with 4-horse plow March 3d; dug, manures applied, and middles split out March 31st; subsequent workings with disk cultivator; laid by with 4-horse plow.

There is appended a table with list of manures and results; also a diagram of the plat with explanation. Basal mixture in this plat means 540 lbs. cotton seed meal, 540 lbs. kainite.

TABLE 7.

PLAT NO. 7—PHOSPHORIC ACID MANURES.

	Manures Used Per Acre.	Yield per Acre in Tons.	Analyses. Degrees Baume.	Analyses. Total Solids.	Analyses. Sucrose.	Analyses. Glucose	Purity Coefficient.	Glucose Ratio.	lbs available sugar upon 70 p c extraction: Per ton	lbs available sugar upon 70 p c extraction: Per acr.	When Harvested	Remarks.
1	Basal mixture	27.05	7.9	14.2	10.5	1.60	74.00	15.24	113.4	3067	Oct 14	Dissolved Bone Bl'k Group.
2	Basal mixture 180 lbs Dissolved Bone Black	27.96	7.6	13.7	10.	1.95	73.00	19.50	99.05	2768	"	
3	Nothing	18.02	7.7	13.9	10.	2.00	72.00	20.00	98.	1766	"	
4	Basal mixture 360 lbs Dissolved Bone Black	28.42	7.6	13.7	10.5	1.85	76.64	17.62	108.11	3069	"	
5	Basal mixture 540 lbs Dissolved Bone Black	31.95	7.9	14.2	11.	1.65	77.46	15.00	119.3	3812	"	
6	Basal mixture	22.89	8.4	15.2	12.5	1.50	82.24	12.00	143.5	3285	Oct 15	Acid Phosphate Group.
7	Basal mixture 180 lbs Acid Phosphate	28.84	7.5	13.6	11.	2.00	80.88	18.18	112.	3230	"	
8	Nothing	19.49	7.8	14.1	11.1	2.04	79.43	18.20	114.	2220	"	
9	Basal mixture 360 lbs Acid Phosphate	24.99	7.6	13.7	10.5	1.61	76.64	15.33	113.2	2823	Oct 17	
10	Batal mixture 540 lbs Acid Phosphate	30.90	7.7	13.9	10.8	1.72	77.69	15.92	116.	3584	"	
11	Basal mixture	25.35	8.3	14.9	12.6	1.23	84.56	9.76	150.	3802	"	Precipitated Bone Bl'k Gr'p.
12	Basal mixture 180 lbs Precipitated Bone Black	26.36	8.1	14.6	12.4	1.36	84.93	10.96	144.	3791	"	
13	Nothing	19.07	7.9	14.2	11.3	1.66	79.57	14.70	124.	2365	Oct 18	
14	Basal mixture 360 lbs Precipitated Bone Black	24.99	7.9	14.2	12.	1.56	84.50	13.00	135.2	3379	"	
15	Basal mixture 540 lbs Precipitated Bone Black	24.81	8.0	14.4	11.9	1.43	82.64	12.01	136.5	3386	"	
16	Basal mixture	23.31	8.2	14.8	12.4	1.47	83.79	11.85	142.7	3326	"	Precipitated Acid Ph'sphate Group.
17	Basal mixture 180 lbs Precipitated Bone Black	23.94	8.0	14.5	11.9	1.37	82.06	11.51	138.	3303	Oct 19	
18	Nothing	18.65	8.0	14.5	10.5	1.69	72.41	16.10	111.5	2076	"	
19	Basal mixture 360 lbs Precipitated Acid Phosphate	23.62	8.2	14.89	11.2	1.46	75.22	13.04	126.	2976	"	
20	Basal mixture 540 lbs Precipitated Acid Phosphate	27.23	8.2	14.89	12.5	1.52	83.95	12.15	143.	3893	"	

TABLE 7—*Continued.*

No. Exp't	Manures Used Per Acre.	Yield per acre in tons.	Analyses. Degrees Baume.	Total Solids.	Sucrose.	Glucose	Purity Coefficient	Glucose Ratio	lbs available sugar upon 70 p c extraction per ton	per acr	When Harvested.	Remarks.
21	Basal mixture	25.27	8.2	14.8	12.5	1.04	84.46	8.32	153.	3870	Oct 20	Bone Dust Group.
22	Basal mixture 180 lbs Bone Dust	25.02	8.2	14.8	12.3	1.08	83.11	8.78	149.	3740	"	
23	Nothing	15.36	8.	14.4	12.3	1.27	85.42	10.32	146.	2242	"	
24	Basal mixture 360 lbs Bone Dust	23.27	8.	14.4	12.3	1.42	85.42	11.54	142.	3313	"	
25	Basal mixture 540 lbs Bone Dust	26.68	8.3	14.9	12.2	1.08	81.88	8.85	148.	3849	"	
26	Basal mixture	19.21	8.6	15.5	13.7	1.01	88.38	7.37	170.	3278	"	R'k Phosphate or Floats Gr.
27	Basal mixture 180 lbs Floats	19.63	8.5	15.4	14.0	1.02	90.91	7.28	175.	3335	"	
28	Nothing	12.39	8.6	15.5	14.1	1.05	90.96	7.45	175.	2173	Oct 21	
29	Basal mixture 360 lbs Floats	22.05	8.5	15.3	12.7	1.35	83.00	10.62	150.	3307	"	
30	Basal mixture 540 lbs Floats	26.24	8.5	15.3	13.1	1.17	85.62	8.93	159.	4171	"	
31	Basal mixture	14.84	8.7	15.7	12.5	1.00	79.61	8.00	154.	2285	"	Natural Ph'sphate Group.
32	Basal mixture 180 lbs Orchilla	22.19	8.8	15.8	13.2	1.18	83.56	8.93	160.	3550	"	
33	Nothing	12.28	8.4	15.1	12.9	1.10	85.43	8.52	158.	1940	"	
34	Basal mixture 360 lbs Orchilla	17.22	8.9	16.0	13.4	1.00	83.12	7.46	167.	2876	"	
35	Basal mixture 540 lbs Orchilla	20.79	8.8	15.8	13.8	.80	87.34	5.80	176.	3659	"	
36	Basal mixture	15.96	9.	16.2	12.7	.80	78.40	6.30	161.	2570	Oct 22	Gypsum Group.
37	Basal mixture 180 lbs Gypsum	16.59	8.7	15.4	12.5	.83	81.17	6.64	158.	2621	"	
38	Nothing	11.34	7.2	12.9	10.6	.88	82.17	8.30	130.	1474	"	
39	Basal mixture 360 lbs Gypsum	15.33	8.5	15.3	12.1	.91	79.08	7.52	150.	2300	"	
40	Basal mixture 540 lbs Gypsum	12.07	8.2	14.8	11.6	.84	78.37	7.24	131.	1581	"	

PLAT VII.—PHOSPHORIC ACID MANURES.

Ground October 14th.

	Basal Mixture	Basal Mixture & ⅓ Ration	Nothing.	Basal Mixture & ⅔ Ration	Basal Mixture & 3.3 Ration	
No. of Experiment......	1	2	3	4	5	Dissolved Bone Black Group.
Yield per acre tons......	27.05	27.96	18.02	28.42	31.95	
Total Solids	14.20	13.70	13.90	13.70	14.20	
Sucrose..................	10.50	10.00	10.00	10.50	11.00	
Glucose..................	1.60	1.95	2.00	1.85	1.65	
lbs av. sugar per acre....	3067	2768	1766	3069	3812	
No. of Experiment......	6	7	8	9	10	Acid Phosphate Group.
Yield per acre tons......	22.89	28.88	19.49	24.99	30.90	
Total solids	15.20	13.60	14.10	13.70	13.90	
Sucrose..................	12.50	11.00	11.20	10.50	10.80	
Glucose..................	1.50	2.00	2.04	1.61	1.72	
lbs. av. sugar per acre...	3285	3230	2220	2823	3584	
No. of Experiment......	11	12	13	14	15	Precipitated Dissolved Bone Black Group.
Yield per acre tons......	25.36	26.36	19.07	24.99	24.81	
Total Solids.............	14.90	14.60	14.20	14.20	14.40	
Sucrose..................	12.60	12.40	11.30	12.00	11.90	
Glucose..................	1.23	1.36	1.66	1.56	1.43	
lbs. av. sugar per acre...	3802	3794	2365	3379	3386	
No. of Experiment......	16	17	18	19	20	Precipitated Acid Phosphate Group.
Yield per acre tons......	23.31	23.94	18.65	23.62	27.23	
Total Solids	14.80	14.50	14.50	14.89	14.89	
Sucrose..................	12.40	11.90	10.50	11.20	12.50	
Glucose..................	1.47	1.37	1.69	1.46	1.52	
lbs. av. sugar per acre...	3326	3303	2076	2976	3893	
No. of Experiment......	21	22	23	24	25	Bone Dust Group.
Yield per acre tons......	25.27	25.02	15.36	23.27	26.68	
Total Solids	14.80	14.80	14.40	14.40	14.90	
Sucrose..................	12.50	12.30	12.30	12.30	12.20	
Glucose..................	1.04	1.08	1.27	1.42	1.08	
lbs. av. sugar per acre...	3870	3740	2242	3313	3849	
No. of Experiment......	26	27	28	29	30	Rock Phosphate or Floats Group.
Yield per acre tons......	19.21	19.63	12.37	22.05	26.24	
Total Solids	15.50	15.40	15.50	15.30	15.30	
Sucrose..................	13.70	14.00	14.10	12.70	13.10	
Glucose..................	1.01	1.02	1.05	1.35	1.17	
lbs. av. sugar per acre...	3270	3335	2173	3307	4171	
No. of Experiment......	31	32	33	34	35	Orchilla Group.
Yield per acre tons......	14.84	22.19	12.28	17.22	20.79	
Total Solids	15.70	15.80	15.10	16.00	15.80	
Sucrose..................	12.50	13.20	12.90	13.40	13.80	
Glucose..................	1.00	1.18	1.10	1.00	.80	
lbs. av. sugar per acre...	2285	3550	1940	2876	3659	
No. of Experiment......	36	37	38	39	40	Gypsum Group.
Yield per acre tons......	15.96	16.59	11.34	15.33	12.07	
Total Solids	16.20	15.40	12.90	15.30	14.80	
Sucrose..................	12.70	12.50	10.60	12.10	11.60	
Glucose..................	.80	.83	.88	.91	.84	
lbs. av. sugar per acre...	2570	2621	1474	2300	1581	

By comparing in each group the "basal mixture" with the "basal mixture mixed with the phosphate" we obtain the benefit derived from the phosphoric acid, and by comparing them with the unfertilized experiments, we obtain the increase due to the manure. It must be noted however, that the "nothings" occupied the conter of the plat and from their location were naturally better than the rest of the plat. This natural advantage was recognized before planting, but no better arrangement could be devised.

By inspecting the diagram it will be found that the basal mixture occupied the extreme left of the plat, adjoining the "tiled drained plat." In fact the tiles ran within a few feet of the row and some of the results of this basal mixture must be assigned to tiles. We thus account for the unusually small differences which occur here but not elsewhere on the Station, between the use of basal mixture and basal mixture and phosphates.

Taking each group up separately we have for Group 1 Dissolved Bone Black.

GROUP 1.

	Tons.	lbs. available sugar.
Yield of nothing per acre	18.02	1766
Yield of Basal Mixture	27.05	3067
Yield of 1.3 ration Dissolved Bone Black	27.96	2768
Yield of 2-3 ration Dissolved Bone Black	28.42	3069
Yield of 3-3 ration Dissolved Bone Black	31.95	3812
Increase due to 1-3 ration over Basal Mixture	.91	
Increase due to 2-3 ration over Basal Mixture	1.37	2
Increase dne to 3-3 ration over Basal Mixture	4.90	745
Increase Basal Mixture over nothing	9.03	1301
Increase 1-3 ration over nothing	9.94	1002
Increase 2-3 ration over nothing	10.40	1303
Increase 3-3 ration over nothing	13.93	2046

Comparing each group in this way we have:

GROUP 2.

	Tons.	lbs. available sugar.
Increase Basal Mixture over nothing	3.40	1065
Increase 1-3 ration Acid Phosphate over nothing	9.35	1010
Increase 2-3 ration Acid Phosphate over nothing	5.50	603
Increase 3-3 ration Acid Phosphate over nothing	11.40	1364

GROUP 3.

	Tons.	lbs. available sugar.
Increase Basal Mixture over nothing	6.28	1437
Increase 1-3 ration Prec. Dissolved Bone over nothing	7.29	1429
Increased 2-3 ration Prec. Dissolved Bone over nothing	5.92	1014
Increased 3-3 ration Dissolved Bone over nothing	5.74	1021

GROUP 4.

	Tons.	lbs. available sugar.
Increase Basal Mixture over nothing	4.66	1250
Increase 1-3 ration Prec. Acid Phosphate over nothing	5.29	1227
Increase 2-3 ration Prec. Acid Phosphate over nothing	4.97	900
Increase 3-3 ration Pree. Acid Phosphate over nothing	8.58	1817

GROUP 5.

	Tons.	lbs. available sugar.
Increase of Basal Mixture over nothin	9.91	1628
Increase of 1-3 ration Bone Dust over nothing	9.36	1498
Increase of 2-3 ration Bone Dust over nothing	7.91	1071
Increase of 3-3 ration Bone Dust over nothing	11.32	1607

GROUP 6.

	Tons.	lbs. available sugar.
Increase of Basal Mixture over nothing	6.82	1105
Increase of 1-3 ration Floats over nothing	7.24	1262
Increase of 2-3 ration Floats over nothing	9.66	1134
Increase of 3-3 ration Floats over nothing	13.85	1998

GROUP 7.

	Tons.	lbs. available sugar.
Increase of Basal Mixture over nothing	2.56	345
Increase of 1-3 ration Orchilla over nothing	9.91	1610
Increase of 2-3 ration Orchilla over nothing	4.94	936
Increase of 3-3 ration Orchilla over nothing	8.51	1719

GROUP 8.

	Tons.	lbs. available sugar.
Increase of Basal Mixture over nothing	4.62	1096
Increase of 1-3 ration Gypsum over nothing	5.25	1147
Increase of 2-3 ration Gypsum over nothing	3.99	826
Increase of 2-3 ration Gypsum over nothing	.73	107

It is evident from above that phosphates have increased the tonnage, but the sugar content is not increased proportionately as was to be expected. The tiled draining assisted doubtless the maturity of the basal mixture. This plat was ground Oct. 14th, most too early for large sugar contents. Large quantities of phosphates have again not proven remunerative. Of the forms of phosphoric acid used the soluble in dissolved bone black and acid phosphate, and the insoluble in floats and orchilla have given best results. That in bone dust has given no increase over basal mixture alone. Gypsum too seems to be without effect.

PLAT VIII—POTASSIC MANURES.

STUBBLE CANE—HARVESTEB NOVEMBER 1-3.

This plat was designed to test permanently the requirements of this soil for potash, and then to determine the form and quantity best adapted to cane. There has been used the muriate, sulphate, nitrate, carbonate and kainite, and such quantities of each have been taken as to represent 60, 120 and 180 lbs of pure potash per acre, or 1-3, 2-3 and 3-3 rations. These are excessive quantities, but they are used with the hope of determining whether potash in any form or quantity effected the tonnage or sugar content of cane. This plat was off barred with 4-horse plow March 2d, hoed March 28th and 29th, and fertilizers applied March 31st, 1887, and middles split out. Subsequent treatment with disk cultivator. Laid by with 4-horse plow.

TABLE .8

RESULTS OF PLAT NO. 8—POTASSIC MANURES

No. of Exp't	Manures Used Per Acre.	Yield per Acre in Tons	Analyses. Degrees Baume.	Analyses. Total Solids	Analyses. Sucrose.	Analyses. Glucose	Purity Coefficient	Glucose Ratio.	lbs available sugar upon 70 p c extraction Per ton	lbs available sugar upon 70 p c extraction Per acr.	When Harvested	Remarks.
6	Meal Phosphate	26.39	8.8°	15.97	13.4	1.25	83.90	9.32	161.4	4259	Oct 31	
7	Meal Phosphate 120 lbs. Muriate Potash	28.28	8.6	15.57	13.3	1.25	85.42	9.37	160.0	4525	"	
8	Nothing	21.26	8.4	15.17	13.	1.40	85.69	10.77	152.6	3044	"	Muriate Potash Group.
9	Meal Phosphate 240 lbs. Muriate Potash	30.55	8.4	15.17	13.	1.22	85.69	9.38	156.4	4778	"	
10	Meal Phosphate 360 lbs Muriate Potash	*	8.9	16.07	13.5	1.17	84.00	8.67	164.5	——	"	
11	Meal Phosphate	——	8.4	15.27	12.6	1.28	82.51	10.16	149.5	——	Nov 1	
12	Meal Phosphate 480 lbs. Kainite	25.62	8.5	15.37	13.1	1.22	85.23	9.31	157.8	4043	"	
13	Nothing	19.78	8.2	14.87	11.7	1.47	78.68	12.56	133.0	2631	"	Kainite G'rp
14	Meal phosphate 960 lbs. Kainite	27.65	8.4	15.27	12.4	1.20	81.20	9.67	148.4	4103	"	
15	Meal Phosphate 1440 lbs Kainite	*	8.6	15.67	12.9	1.00	82.32	7.75	159.6	——	"	
16	Meal Phosphate	21.21	9.0	16.37	14.8	.90	90.41	6.08	188.3	3994	Nov 2	
17	Meal Phosphate 120 lbs. Sulphate Potash	25.45	8.8	15.91	14.	1.28	88.00	9.15	169.1	4304	"	Sulphate of Potash Gr'p.
18	Nothing	13.34	8.6	15.61	13.8	1.22	88.40	8.84	167.6	2236	"	
19	Meal Phosphate 240 lbs. Sulphate Potash	27.09	8.5	15.41	13.5	1.37	87.60	10.14	169.3	4586	"	
20	Meal Phosphate 360 lbs. Sulphate Potash	*	8.5	15.41	13.5	1.37	87.60	10.14	169.3	——	"	
21	Meal Phosphate	19.00	8.8	15.81	13.5	1.07	85.39	7.92	166.6	3165	"	Carbonate of Potash Group.
22	Meal Phosphate 82½ lbs. Carbonate Potash	23.90	9.1	16.41	14.7	.95	89.58	6.46	185.9	4443	"	
23	Nothing	16.24	8.6	15.61	13.3	1,37	85.20	10.30	157.5	2558	"	

24	Meal Phosphate 165 lbs. Carbonate Potash	25.10	8.8	15.91	13.9	1.17	87.36	8.41	156.1	3918	"	
25	Meal Phosphate 247½ lbs. Carbonate Potash	*	8.7	15.71	13.7	1.28	87.20	9.34	164.9	....	"	
26	Meal Phosphate	19.00	9.0	16.31	14.1	1.22	86.45	8.65	171.8	3364	"	Nitrate of Potash Gr'p.
27	Meal Phosphate 135 lbs. Nitrate Potash	22.85	8.8	15.81	13.5	1.28	85.39	9.41	162.1	3704	"	
28	Nothing	16.41	8.5	15.31	12·7	1.28	82.95	10.08	150.9	2476	"	
29	Meal Phosphate 270 lbs. Nitrate Potash	27.51	8.6	15.57	12.	1.35	77.07	11.25	139.7	3843	"	
30	Meal Phosphate 405 lbs. Nitrate Potash	*	8.5	15.31	12.5	1.05	81.64	8.40	153.0	....	"	

*These experiments occupied the extreme northern portion of the farm and were depredated upon largely by freedmen from adjoining plantation, hence the tonnage per acre was seriously vitiated and is not given.

PLAT VIII.—POTASSIC MANURES.

No. of Experiment	6	7	8	9	10	
Yield per acre in tons	26.39	28.28	21.26	30.65	*	
Total Solids	15.97	15.57	15.17	15.17	16.07	Muriate Potash Group.
Sucrose	13.40	13.30	13.00	13.00	13.50	
Glucose	1.25	1.25	1.40	1.22	1.17	
lbs. available sugar 70 per cent extraction per acre	4259	4525	3044	4778	....	
No. of Experiment	**11**	**12**	**13**	**14**	**15**	
Yield per acre in tons	....	35.62	19.78	27.65	*	
Total Solids	15.27	15.37	14.87	15.27	15.67	Kainite Group.
Sucrose	12.60	13.10	11.70	12.40	12.90	
Glucose	1.28	1.22	1.47	1.20	1.00	
lbs. available sugar 70 per cent extraction per acre	....	4043	1631	4103	....	
No. of Experiment	**16**	**17**	**18**	**19**	**20**	
Yield per acre in tons	21.21	25.45	13.34	27.09	*	
Total Solids	16.37	15.91	15.61	15.41	15.41	Sulphate Potash Group
Sucrose	14.80	14.00	13.80	13.50	13.50	
Glucose	.90	1.28	1.22	1.37	1.37	
lbs. available sugar 70 per cent extraction per acre	3994	4304	2236	4586	....	
No. of Experiment	**21**	**22**	**23**	**24**	**25**	
Yield per acre in tons	19.00	23.90	16.24	25.10	*	
Total Solids	15.81	16.41	15.61	15.91	15.71	Carbonate Potash Group
Sucrose	13.50	14.70	13.30	13.90	13.70	
Glucose	1.07	.95	1.37	1.17	1.28	
lbs. available sugar 70 per cent extraction per acre	3165	4443	1558	3918	....	
No. of Experiment	**26**	**27**	**28**	**29**	**30**	
Yield per acre in tons	19.00	22.85	16.41	27.51	*	
Total Solids	16.31	15.81	15.31	15.57	15.31	
Sucrose	14.10	13.50	12.70	12.00	12.50	Nitrate Potash Group
Glucose	1.22	1.26	1.28	1.35	1.05	
lbs. available sugar 70 per cent extraction per acre	3364	3704	2476	3843	....	
	Meal Phosphate	Meal Phosphate & ⅓ Ration.	No Manure.	Meal Phosphate & ⅔ Ration.	Meal Phosphate & 3-3 Ration.	

By combining as we did under Plat 7, we have

GROUP 1.

	Tons.	lbs. available sugar.
Increase of Meal Phosphate over nothing....................	5.13	1215
Increase of 1-3 ration of Muriate over nothing.................	7.02	1481
Increase of 2-3 ration of Muriate over nothing.................	9.29	1734

GROUP 2.

	Tons.	lbs. available sugar.
Increase of Meal Phosphate over nothing		
Increase of 1-3 ration of Kainite over nothing	5.84	1412
Increase of 2-3 ration of Kainite over nothing.................	7.87	1472

GROUP 3.

	Tons.	lbs. available sugar.
Increase of Meal Phosphate over nothing	7.87	1758
Increase of 1-3 ration Sulphate over nothing	12.11	2068
Increase of 2-3 ration Sulphate over nothing	13.75	2350

GROUP 4.

	Tons.	lbs. available sugar.
Increase of Meal Phosphate over nothing	2.76	607
Increase of 1-3 ration Carbonate over nothing..................	7.66	1885
Increase of 2-3 ration Carbonate over nothing	8.86	1360

GROUP 5.

	Tons.	lbs. available sugar.
Increase of Meal Phosphate over nothing	2.59	888
Increase of 1-3 ration Nitrate over nothing....................	6.44	1228
Increase of 2-3 ration Nitrate over nothing....................	11.10	1367

From the above it will be seen that every form of potash has increased the tonnage more or less over meal phosphate without enhancing the sugar content. This will readily be seen by inspecting the columns of "yield per acre" and "available sugar per ton." It will be seen too that increased quantities have given increased yields. This is decidedly perplexing, for our experiments elsewhere this year and last year showed no increase due to potash. The results are also contrary to those obtained at the Barbadoes Agricultural Experiment Station for 1886. In the summary of conclusions arrived at on the action of the manures, in the report of this Station for 1886 we find:

6. "The addition of potash to manurings of superphosphate and nitrogen may not increase the yield of total produce to any very marked extent but from its tendency to increase the development of the cane causes a large increase in the amount of of available sugar in the juice.

7. The presence of potash in the manures in rather high relative proportions apparently tends to increase the amount of sucrose in the canes. This point is worthy of further investigations.

8. The presence of an excess of potash in the manures does not injuriously effect the purity of the juice by increasing the glucose or appreciably the amount of potash salts contained in it.

An inspection of our results will show that potash has increased the tonnage to a marked extent; in one instance No. 29 as much as 8½ tons over No. 26 meal and phosphate, and the lowest No. 7, 1.89 tons over No. 6 meal and phosphate, but there is no large increase in available sugar per ton, where potash was used Again increased quantities of potash have not given increased amounts of sucrose in the canes.

This Station concurs in the first part of the 8th conclusion, viz., that excess of potash has not increased the glucose in the juice, but dissents for the present from the last part. Our labaratory experiments in the analyses of ash from juices from this plat for this year are not yet complete. They will be ready for our Bulletin on the "Sugar House", which will appear later. But our experiments of last year indicated that excessive quantities of potash in manures are probably detrimental to the yield of sugar. See Bulletin No. 10, pages 71 and 72.

Our conclusion from this plat is that potash has simply increased the tonnage of cane without effecting the sucrose or glucose. Whether this increase is due to the potash "per se" or to its indirect action as a solvent of plant food already in the soil is yet an unsolved problem. It is known to all agriculturists that certain manures stimulate only, i. e. act as a reagent to disintegrate and bring in solution the plant food already contained in the soil. Under this head come gypsum, lime, salt, etc. These excessive doses of potash were applied to these identical plats in 1886 and 1887. They were without appreciable effect in 1886. It may be that these good effects in 1887 are to be ascribed entirely to their solvent influences upon this stiff black land, acting through nearly two years, bringing in solution large quantities of nitrogen from the organic matter present, which has given an increased growth to the cane. This subject will receive full investigation in the future. For the present, it suffices to know that potassic manures used in large quantities upon these black lands, did produce an increased tonnage.

PLAT XV—PLANT CANE.

In the spring of 1886 this plat was sown broadcast in cow peas. A luxuriant growth of vines was obtained. In September the plat was divided into two equal parts. The pea vines on the west side were removed, cured into hay, and fed to the stock. The entire plat was then turned over with a 4-horse plow. There was thus presented a basis for an experiment with and without pea vines, to test the value of first, the roots alone, and second, the roots and vines. A portion of this plat was planted with plant and the rest with stubble cane. It was also divided into 5 groups of 4 experiments each.

First and second groups next to the river were fertilized at the time of planting, the fourth and fifth groups furthest from the river, in the spring, and the third or middle group was not fertilized at all. Each group had thus two experiments with pea vines turned under, add two with vines removed. The manures were duplicated on both. In group 1, cotton seed meal, acid phosphate and kainite were used as manure. In experi-

ment 1, the meal and phosphate were combined in proportion of 2 to 1. In experiment 2, in equal quantities. The kainite was constant in both.

Group 2 was manured like Group 1, except the kainite was omitted.

Group 3 was unmonured.

In Group 4 experiment 1, the nitrogen was supplied in form of nitrate soda, sulphate ammonia and cotton seed meal. Of the whole amount of nitrogen supplied $\frac{3}{8}$ was in form of nitrate soda, $\frac{3}{8}$ in sulphate of ammonia, and 2-8 in cotton seed meal. This was combined with acid phosphate and kainite.

Experiment 2 of same group, had all its nitrogen in form of nitrate of soda, which was also combined with acid phosphate.

In Group 5, experiment 1, dried blood and sulphate of ammonia supplied the nitrogen, while sulphate of ammonia alone was used in experiment 2. Both had also acid phosphate and kainite. The following are manures used :

PLAT XV—PLANT CANE.

Experiment 1—	300 lbs Cotton Seed Meal	Applied Oct. 18th.
	150 lbs cotton Seed Meal	
	100 lbs Kainite	
	200 lbs Cotton Seed Meal	Applied June 3d.
	100 lbs Acid Phosphate	
Experiment 2—	300 lbs Cotton Seed Meal	Applied Oct. 18th.
	300 lbs Acid Thosphate	
	100 lbs Kainite	
	200 lbs Acid Phosphate	Applied June 3d.
	200 lbe Cotton Seed Meal	
Experiment 3—	Like (1) without Kainite.	
Experiment 4—	Like (2) without Kainite.	
Experiment 5—	No manurc.	
Experiment 6—	No manure.	
Experiment 7—	100 lbs Nitrate Soda	Applied March 18.
	70 lbs Sulphate Ammonia	
	300 lbs Cotton Seed Meal	
	300 lbs Acid Phosphate	
	100 lbs Kainite	Applied June 3d.
	100 lbs Nitrate Soda	
	70 lbs Sulphate Ammonia	
Experiment 8—	300 lbs Nitrate Soda	March 18th.
	300 lbs Acid Phosphate	
	100 lbs Kainite	
	300 lbs Nitrate Soda	Applied June 3d.
Experiment 9—	100 lbs Sulphate Ammonia	March 18th.
	200 lbs Dried Blood	
	300 lbs Acid Phosphate	
	100 lbs Kainite	
	100 lbs Sulphate Ammonia	Applied June 3d.
Experiment 10—	200 lbs Sulphate Ammonia	Applied March 18th.
	300 lbs Acid Phosphate	
	100 lbs Kainite	
	200 lbs Sulphate Ammonia	Applied June 3d.

The following is the table of resnlts, and diagram of plat.

PLAT NO. XV.—PLANT CANE.

No. of Expt.	Manures Used, Per Acre.	Disposition of Pea Vines	Yield Per Acre in Tons	Analyses. Degrees Baume.	Analyses. Total Solids.	Analyses. Sucrose	Analyses. Glucose.	Coefficient of Purity.	Glucose Ratio.	lbs. available sugar upon 70 p c extraction Per ton	lbs. available sugar upon 70 p c extraction Per acre	When Ground.	Remarks.
1	500 lbs. Cotton Seed Meal 250 lbs. Acid Phosphate 100 lbs. Kainite	Turned in	38.60	7.8	14.13	11.30	1.57	80.	13.89	125	4825	Nov. 18	
1	Ditto	Removed	38.88	7.4	13.43	10.00	1.57	74.46	15.	107	4160	"	
2	500 lbs. Cotton Seep Meal 500 lbs. Acid Phosphate 100 lbs. Kainite	Turned in	40.60	7.4	13.43	10.00	1.40	74.43	14.	111	4507	"	
2	Ditto	Removed	41.38	8.	14.50	11.20	1.30	77.24	11.60	132	5462	"	
3	500 lbs. Cotton Seed Meal 250 lbs. Acid Phosphate	Turned in	39.07	7.9	14.20	11.20	1.40	78.77	12.50	127	4962	"	
3	Ditto	Removed	35.14	8.	14.43	10.80	2.36	74.84	21.85	102	3584	Nov. 17	Inj'd by sh'd
4	500 lbs. Cotton Seed Meal 500 lbs. Acid Phosphate	Turned in	40.91	7.5	13.63	10.50	1.40	77.02	13.33	116	4746	"	
4	Ditto	Removed	33.30	8.4	15.23	11.30	2.33	74.19	20.61	109	3630	"	Inj'd by sh'd
5	No Manure	Turned in	33.92	7.9	14.37	10.70	2.00	74.46	18.69	108	3663	" 15	
5	No Manure	Removed	33.59	7.7	13.91	10.20	1.93	73.32	18.92	102	3426	"	
6	No Manure	Turned in	36.36	7.8	14.17	10.60	1.96	74.80	18.49	107	3890	"	
6	No Manure	Removed	33.45	8.4	15.07	11.20	1.93	74.32	17.23	116	3880	"	
7	200 lbs. Nitrate Soda 140 lbs. Sulphate Ammonia 300 lbs. Cotton Seed Meal 300 lbs. Acid Phosphate 100 lbs. Kainite	Turned in	37.97	7.1	12.77	8.00	2.36	62.64	29.50	62	2354	"	
7	Ditto	Removed	37.36	7.2	12.87	9.20	2.18	71.48	23.69	83	3101	"	
8	600 lbs. Nitrate Soda 300 lbs. Acid Phosphate 100 lbs. Kainite	Turned in	39.45	7.2	12.87	9.60	2.08	74.59	21.66	85	3353	"	

	8	Ditto	Removed	37.36	7.3	13.17	9.20	2.30	69.85	26.08	81	3110	"
4	9	200 lbs Sulphate Ammonia 200 lbs. Dried Blood 300 lbs. Acid Phosphate 100 lbs. Kainite	Turned in	39.45	7.4	13.33	10.60	1.84	79.52	17.35	110	4653	Nov. 9
	9	Ditto	Removed	38.34	6.6	11.93	8.00	2.00	67.05	25.	70	2904	"
	10	400 lbs. Sulphate Ammonia 300 lbs. Acid Phosphate 100 lbs. Kainite	Turned in	42.30	7.1	12.83	9.00	1.95	70.14	21.64	85	3726	"
	10	Ditto	Removed	41.48	6.9	12.43	9.10	1.84	73.21	20.22	89	3355	"

PLAT XV.—PLANT CANE.

	Pea Vines Turned under		Pea Vines Removed.				
No. of Experiment...	1	2	1	2	Fall Fertilized	Plant Cane.	GROUP 1.
Yield per acre in tons	38.60	40.60	38.88	41.38			
Total Solids	14.13	13.43	13.43	14.50			
Sucrose	11.30	10.00	10.00	11.20			
Glucose.............	1.57	1.40	1.57	1.30			
lbs. av. sugar per acre	4825	4507	4160	5462			
No. of Experiment..	3	4	3 *	4 *			GROUP 2. Without Potash.
Yield per acre in tons	39.07	40.91	35.14	33.30			
Total Solids	14.20	13.63	14.43	15.23			
Sucrose.............	11.20	10.50	10.80	11.30			
Glucose.............	1.40	1.40	2.36	2.33			
lbs. av. sugar per acre	4962	4746	3584	3630			
No. of Experiment ..	5	6	5	6			GROUP 3. No Manure.
Yield per acre in tons	33.92	36.36	33.59	33.45			
Total Solids	14.37	14.17	13.91	15.07			
Sucrose	10 70	10.60	10.20	11.20			
Glucose.............	2.00	1.96	1.93	1.93			
lbs. av. sugar per acre	3663	3890	3426	3880			
No. of Experiment _	7	8	7	8	Spring Fertilized.	Stubble Cane.	GROUP 4.
Yield per acre in tons	37.97	39.45	37.36	38.39			
Total Solids	12.77	12 87	12.87	13.17			
Sucrose	8.00	9.60	9.20	9.20			
Glucose.............	2.36	2.08	2.18	2.30			
lbs. av. sugar per acre	2354	3353	3101	3110			
No. of Experiment ..	9	10	9	10			GROUP 5.
Yield per acre in tons	42.30	43.83	41.48	37.70			
Total Solids	13.33	12.83	11.93	12.43			
Sucrose.............	10.60	9.00	8.00	9.10			
Glucose.............	1.84	1.95	2.00	1.84			
lbs. av. sugar per acre	4653	3726	2904	3355			

* Injured by proximity of large pecan tree.

It may be interesting to know the exact contents of each ingredient per acre in each experiment. A table is here given Upon Nos. 7, 8, 9 and 10, excessive quantities of nitrogen were used to demonstrate the fact that large tonnage low in sugar always results:

	lbs. of nitrogen per acre.	lbs. of phosphoric acid per acre.	lbs. of potash per acre.	average tons per acre.	Average available sugar pr. acr.
Experiment No. 1	35.00	52.50	22.00	38.74	4493
" " 2	35.00	90.00	22.00	40.99	4985
" " 3	35.00	52.50	10.00	39.07	4962
" " 4	35.00	90.00	10.00	40.91	4746
" " 7	81.00	54.00	18.00	37.66	2728
" " 8	84.00	45.00	12.00	38.92	3231
" " 9	66.00	45.00	12.00	41.89	3778
" " 10	84.00	45.00	12.00	40.76	4004

One fact is here clearly demonstrated by the last four experiments, viz, that excessive quantities of nitrogenous manures induce large tonnage poor in sugar. Here we have 37 and 44 tons of cane to the acre with the available sugar running as low as 2354 lbs. per acre. It has been shown under nitrogenous manures that a ration containing from 24 to 48 lbs. of nitrogen was abuadant for best results. These experiments confirm those in a most positive manner. Has kainite benefitted this cane either in tonnage or sugar content? Comparing group 1 with 2, we find no superiority in weight or sucrose. The portion of this plat planted with plant had no advantage over that planted with stubble except the former earlier came to a stand.

The main question asked of this plat is what benefit is to be derived from turning under the pea vines. To answer this question a comparison of results must be made.

	Tons.	lbs avail. sugar.
Sum of experiments with vines turned under......	393.01	40.482
Sum of experiments with vines removed..........	370.67	36.612
Difference due to vines..............................	22.34	3.870
Average increase per acre due to vines.............	2.23	387

Omitting experiments 3 and 4, which were modified by the presence of a large pecan tree many feet away, we have average increase per acre due to vines 1.08 tons and 138 lbs available

sugar; quantities quite small in view of the large amount of vines turned under.

Perhaps in view of the large amount of fertilizers applied to a portion of this plat, it would be best to compare only those experiments upon which no manure was applied. Doing this we have an increase per acre due to vines turned under of 1.62 tons of cane, and 123 lbs. of available sugar.

ANALYSES OF PEA VINES AND ROOTS.

The great difference of opinion among farmers and planters as to the value of pea vines as a green manure caused the Station to institute the above experiments together with those that are about to be described. All admit the great value to the succeeding crop of cane, of a crop of peas, grown either alone or with corn, but it is strongly contended by some that the vines can be removed for feed without injury to the subsequent crops, that the roots alone, after the vines are permitted to shade the ground through the summer, are valuable as plant food. Others assert that the turning in of green vines in the fall is an absolute injury, and if turned in at all, it should be done only in the spring after they have served as a mulch through the winter. Such differences of opinion arise largely from the character and condition of the soil, seasons and subsequent cultivation. To test the absolute value in plant food of a crop of vines and roots, the following experiments were instituted here during the past summer.

In a piece of land upon which the cow pea, Clay variety, sown broadcast was growing, a small plat 10 by 10 square, was selected, and the vines carefully cut with a scythe in the usual way. These vines were weighed at once, taken to the laboratory, thoroughly dried and analyzed. Around this plat a ditch 18 inches deep was dug, and with a strong force spray pump the roots were carefully washed up, weighed, dried and analysed. The vines were reaching maturity, had passed the vines when they should have been cut for hay, had very few pods on them, and as the analyses shows contained much woody fibre. The top roots contrary to expectation, were quite short, rarely going below 8 inches. The lateral roots were very numerous, pene-

trating the soil in every direction, growing a network of roots and rootlets wonderful to behold, and proving conclusively that no amount of labor could *artificially* incorporate vegetable matter so completely and perfectly with the soil. Some of these laterals were also quite large, approximating in size, the tap roots at a few inches below the soil. To this mechanical separation and disintegration of the soil, must be ascribed some of the good effects of peas upon the alluvial lands of south Louisiana, to say nothing of the aid to drainage which these vegetable fibres soon converted into ducts or small tiles, engender. Leaving out of consideration at present, the mechanical effects produced in our stiff lands by a crop of peas, let us ask the question what amount of chemical food do they possess, both vines and roots.

The following are the results of the work done September 12th, 13th and 14th, calculated to the acre.

Amount of green vines removed per acre	21.345 lbs
Amount of roots washed up per acre	3.464 "
Amount of vines after being thoroughly dried	3.330 "
Amount of roots after being thoroughly dried	1.040 "
Total dry matter per acre	4.370 lbs.

It is proper to add here that despite our persistent and careful efforts for three days, the time devoted to washing up these roots, that a considerable quantity of the smaller hair roots escaped us. However, the aggregate weight of these must have been very small.

ANALYSES OF DRIED VINES.

*Organic matter	90.26
Ash	9.74
*Containing nitrogen	1.70 per cent

ASH CONTAINED.

Phosphoric acid	4.92 per cent
Potash	28.51 " "
Lime	10.31 " "

ANALYSES OF DRIED ROOTS.

*Organic matter	92.58 per cent
Ash	7.42 " "
*Containing nitrogen	.80 " "

ASH CONTAINED.

Phosphoric acid	5.73 per cent
Potash	23.42 " "
Lime	13.14 " "

Applying these analyses we have on one acre of cow pea roots:

Organic matter	964.68 lbs
Mineral matter	77.32 "

CONTAINING

Nitrogen	8.34 lbs
Phosphoric acid	4.43 "
Potash	18.10 "
Lime	10.16 "

ONE ACRE OF COW PEA VINES.

Orgonic matter	3005.70 lbs
Mineral matter	324.30 "

CONTAINING

Nitrogen	56.61 lbs
Phesphoric acid	15.96 "
Potash	92.46 "
Lime	32.44 "

One acre therefore of pea roots contains of plant food amounts about equal to 120 lbs cotton seed meal and 130 lbs kainite.

One acre of pea vines contains amounts about equal to 800 lbs. cotton seed meal, and 640 lbs kainite, so far as nitrogen and potash are concerned, and over supply of phosphoric acid by about 8 lbs.

When both are returned to the land there is an amount of plant food equal to 920 lbs. cotton seed meal, 770 lbs. kainite.

We thus see that the vines are by far the richer in plant food. Why then do we not readily see the difference in increased yields when the vines are turned under and when they are removed? Many reasons exist. Frequently vines are turned in a continuous layer just below the surface, where they remain for some time undecomposed, greatly to the injury of the soil and crop. Sometimes these vines produce a sourness in the soil, especially when there is a deficiency of lime. In open porous soils vines turned in green in the fall or summer rapidly decompose, and the products of fermentation are leached beyond the reach of the roots of crops by spring. Again vines turned in dry in the fall, often remain undecomposed through the next season; especially in stiff clay soil, and therefore show no apparent benefit the first year. Such is probably the case in our stiff alluvial lands of South Louisiana.

Whatever the opinions of practical men may be, the fact remains that when a heavy crop of vines are turned under, a

large amount of plant food is returned to the soil, which sooner or later must be utilized. It is therefore good economy to turn in the vines whenever we can spare them from our stock. The benefits of the root residues are far more apparent, because so ultimately incorporated with the soil they soon decompose and furnish valuable plant food, at same time by their decomposition.

There is found an innumerable number of little air and water ducts through the soil, and in these the carbonic acid generated by decay will act upon a maximum amount of soil, and through these passages an exces of water will escape, followed by air, which will aid in preparing the soil for the future crop.

Since pea vine hay is so universally used as stock food in Louisiana, it may not be amiss to give the analyses of it when cut very green and fully ripe.

ANALYSES OF PEA VINE HAY.

	When cut ripe.	When cut green.
Albuminoids	10.63	17.01
Cellulose	32.60	24.68
Fat	3.20	2.90
Carbohydrates	43.83	45.98
Ash	9.74	9.43

The above shows that for hay the pea vines should be cut green i. e. just as they begin to form green peds.

Before leaving this subject it may be of interest to state that there was washed up with the roots of the pea vines, coco roots, equal to 3158 lbs. (dried) per acre. They have not yet been analyzed.

PLAT II—STUBBLE CANE.

Offbarred Feb. 3d, and hoed and middles split out March 1st, manures applied March 29th and 30th. Subsequent treatment with disk harrow. Laid by with 4-horse plow.

The object of these experiments is to test the efficacy of certain popular manures, together with the quantities most desirable for most productive results. Accordingly varied quantities of cotton seed meal and acid phosphate, cotton seed meal and floats. Tankage alone in various quantities and combined with other substances, cotton seed alone and in combination, etc.

Results are appended.

TABLE 10.

RESULTS OF PLAT NO. 2—FIRST YEAR STUBBLE.

No. of Exp't	Manures Used Per Acre.	Yield per Acre in Tons	Analyses. Degrees Baume.	Analyses. Total Solids	Analyses. Sucrose.	Analyses. Glucose	Purity Coefficient	Glucose Ratio.	lbs available sugar upon 70 p c extraction Per ton	lbs available sugar upon 70 p c extraction Per acr.	When Harvested	Remarks.
1	200 lbs. Cotton Seed Meal 100 lbs Acid Phosphate	23.28	8.9	16.10	14.90	.80	92.54	5.37	191.80	4465.10	Nov. 21	
2	333 lbs Cotton Meal 167 lbs. Acid Phosphate	28.22	8.3	14.97	12.30	1.21	82.16	9.83	146.79	4142.51	Nov. 22	
3	140 lbs. Sulphate Ammonia 120 lbs. Dried Blood 200 lbs. Cotton Meal 460 lbs. Acid Phosphate 80 lbs. Muriate Potash	33.38	8.2	14.83	11.40	1.18	76.87	10.35	134.82	4500.29	Nov. 23	
4	466 lbs. Cotton Meal 234 lbs. Acid Phosphate	30.20	8.1	14.63	12.40	1.30	84.75	10.48	146.30	4418.26	Nov. 24	
5	600 lbs. Cotton Meal 200 lbs Acid Phosphate	30.20	8.	14.56	11.50	1.13	78.93	9.82	137.27	4145.55	Nov. 26	
6	600 lbs. Cotton Meal 300 lbs. Acid Phosphate 300 lbs. Kainite	28.78	8.1	14.66	11.40	1.04	77.76	9.12	137.76	3964.73	"	
7	600 lbs. Cotton Meal	27.34	8.3	15.06	12.50	1.13	83.00	9.04	151.27	4135.72	"	
8	260 lbs. Sulphate Ammonia 460 lbs. Acid Phosphate 80 lbs. Muriate Potash	32.06	8.3	15.06	12.30	.93	81.67	7.31	152.67	4894.60	"	
9	300 lbs. Acid Phosphate 300 lbs. Kainite	21.26	8.9	16.06	14.10	.64	87.79	4.53	183.96	3910.92	"	
10	300 lbs. Kainite	20.82	9.1	16.56	14.40	.46	86.95	3.19	191.94	3996.19	"	
11	200 lbs. Cotton Meal 100 lbs. Floats	18.70	9.	16.36	13.50	.81	82.51	6.00	171.99	3216.21	"	
12	333 lbs. Cotton Meal 167 lbs. Floats	21.96	8.0	15.86	13.50	.81	85.11	6.00	171.99	3776.90	"	

13	No Manure	17.40	8.8	15.86	13.50	.84	85.11	6.22	171.30	2980.62	
14	466 lbs. Cotton Meal 234 lbs. Floats	24.83	8.5	15.46	12.80	.94	82.79	7.42	159.46	3959.18	
15	600 lbs. Cotton Meal 300 lbs. Floats	27.32	8.5	15.36	13.00	.98	84.63	7.53	161.42	4409.99	
16	600 lbs. Cotton Meal 300 lbs. Floats 300 lbs. Kainite	29.56	8.4	15.16	12.3	1.00	81.13	8.3	151.20	4469.47	
17	600 lbs. Cotton Meal 300 lbs. Floats 300 lbs. Kainite 200 lbs. Gypsum	27.40	8.4	15.26	13.7	.84	89.77	6.3	160.16	4388.38	
18	No Manure	19.14	8.7	15.76	13.6	.86	86.23	6.32	172.34	3298.58	
19	600 lbs. Cotton Meal 300 lbs. Floats 300 lbs. Cotton Hull Ashes	26.18	8.8	15.86	13.7	.94	86.38	6.86	172.06	4504.53	
20	300 lbs. Tankage	19.06	8.9	16.06	13.7	.74	84.05	5.40	176.26	3359.51	
21	450 lbs. Tankage	22.60	9.2	16.66	14.5	.74	87.03	5.10	187.46	4236.59	
22	700 lbs. Tankage	25.68	8.6	15.66	13.8	.86	88.12	6.23	175.14	4497.59	
23	No Manure	18.72	8.8	15.86	14.0	.77	88.27	5.70	179.83	3366.41	
24	900 lbs. Tankage	26.52	8.5	15.46	13.0	.84	84.08	6.46	164.36	4358.82	
25	900 lbs. Tankage 300 lbs. Kainite	27.96	8.7	15.76	13.9	.80	88.19	5.75	177.80	4960.28	
26	900 lbs. Tankage 300 lbs. Kainite 200 lbs. Gypsum	32.12	8.3	15.06	12.0	.86	79.68	7.16	149.94	4816.07	
27	900 lbs. Tankage 300 lbs. Cotton Hull Ashes	25.62	8.4	15.26	12.6	.92	82.56	7.30	157.08	4024.38	
28	No Manure	20.42	8.6	15.66	14.5	.94	92.65	6.48	183.26	3742.16	
29	1700 lbs. Cotton Seed (Raw)	25.38	8.5	15.46	13.6	.98	87.96	7.20	169.82	4310.03	Dec. 3
30	1700 lbs. Cotton Seed (Raw) 300 lbs. Acid Phosphate	27.02	8.8	15.86	14.0	.94	88.27	6.71	176.26	4762.54	Dec. 4
31	1700 lbs. Cotton Seed (Raw) 300 lbs. Acid Phosphate 300 lbs. Kainite	29.02	8.9	16.01	14.4	.76	89.94	5.28	185.64	5387.27	Dec. 5
32	1700 lbs. Cotton Seed (Raw) 300 lbs. Cotton Hull Ashes	26.72	8.6	15.69	14.3	1.00	91.14	7.00	179.20	4788.22	

TABLE 10—*Continued.*

No. Exp't	Manures Used Per Acre.	Yield per acre in tons.	Analyses.				Purity Coefficient	Glucose Ratio	lbs available sugar upon 70 p c extraction		When Harvested.	Remarks.
			Degrees Baume.	Total Solids.	Sucrose.	Glucose			per ton	per acr		
33	No Manure	21.96	8.6	15.56	14.0	.94	89.97	6.71	176.26	3870.66		
34	1700 lbs. Cotton Seed (Raw) 300 lbs. Floats	23.92	8.4	15.16	12.0	1.00	79.15	8.33	147.00	3516.24		
35	1700 lbs. Cotton Seed (Raw) 300 lbs. Floats 200 lbs. Gypsum	28.20	8.4	15.16	13.2	.93	87.07	7.04	165.27	4660.91		

PLAT II.—Stubble Cane.

Harvested November 8th—December 2d, 1887.

No. of Experiment......	1	2	3	4	5
Yield per acre tons......	23.28	28.22	33.38	30.20	30.20
Total Solids	16.10	14.97	14.83	14.66	14.56
Sucrose.................	14.90	12.30	12.10	12.40	11.53
Glucose.................	.80	1.21	1.18	1.30	1.13
lbs av. sugar per acre....	4465	4143	4500	4418	4146
No. of Experiment......	10	9	8	7	6
Yield per acre tons......	20.82	21 26	32.06	27.34	28.78
Total Solids	16.56	16.06	15.06	15.06	14.66
Sucrose.................	14.40	14.10	12.30	12.50	11.90
Glucose.................	.46	.64	.93	1.13	1.04
lbs. av. sugar per acre...	3996	3911	4895	4136	3965
No. of Experiment......	11	12	13	14	15
Yield per acre tons......	18.70	21.96	17.40	24.83	27.32
Total Solids............	16.36	15.86	15.86	15.46	15.36
Sucrose.................	13.50	13.50	13.50	12.83	13.00
Glucose.................	.81	.81	.84	.94	.98
lbs. av. sugar per acre...	3216	3777	2981	3959	4410
No. of Experiment......	20	19	18	17	16
Yield per acre tons......	19.06	26.18	19.14	27.40	29.56
Total Solids	16.06	15.86	15.76	15.26	15.76
Sucrose.................	13.70	13.70	13.60	13.70	12.30
Glucose.................	.74	.94	.86	.84	1.00
lbs. av. sugar per acre...	3360	4505	3299	4388	4469
No. of Experiment......	21	22	23	24	25
Yield per acre tons......	22.60	25.68	18.72	26.52	27.96
Total Solids	16.46	15.66	15.86	15.46	15.76
Sucrose.................	14.50	13.80	14.00	13.00	13.90
Glucose.................	.74	.86	.77	.84	.80
lbs. av. sugar per acre...	4237	4498	3366	4359	4960
No. of Experiment......	30	29	28	27	26
Yield per acre tons......	27.02	25.38	20.42	25.62	32 12
Total Solids	15.86	15.46	15.66	15.26	15.06
Sucrose.................	14.00	13.60	14.50	12.60	12.00
Glucose.................	.94	.98	.94	.92	.86
lbs. av. sugar per acre...	4763	4310	3742	4024	4816
No. of Experiment......	31	32	33	34	35
Yield per acre tons......	29.02	26.72	21.96	23.92	28.20
Total Solids	16.01	15.69	15.56	15.16	15.16
Sucrose.................	14.40	14.30	14.00	12.00	13.20
Glucose.................	.76	1.00	1.00	1.05	.93
lbs. av. sugar per acre...	5387	4788	3870	3516	4661

No Manure

The inspection of above table will show that many of the popular manures are exceedingly valuable; that the different forms of nitrogen in cotton seed, cotton seed meal, tankage and sulphate ammonia, and dried blood, are about equally efficacious as sources of nitrogen, and that large tonnage is not always productive of largest sugar yields, and therefore manuring should be done judiciously both as to quantity and quality.

PLATS IV AND V—SPRING PLANT CANE.

Planted March 3d upon freshly prepared land which had been for years in succession cane. The drouth prevented early fermentation and hence it was May before the sufficient stand was obtained to permit of cultivation.

The following are the manures used per acre on each plat, No IV untiled and No. V tiled; otherwiso the treatment was identical:

Experiment No. 1—	500 lbs. Cotton Seed Meal. 500 lbs. Acid Phosphate. 500 lbs. Kainite.
" " 2—	500 lbs Cotton Seed Meal. 500 lbs Acid Phosphate.
" " 3—	Nothing.
" " 4—	500 lbs Cotton Seed Meal. 500 lbs Orchilla Phosphate. 500 lbs Kainite.
" " 5—	500 lbs Cotton Seed Meal. 500 lbs Orchilla Phosphate.
6—	Nothing.
" " 7—	500 lbs Cotton Seed Meal. 500 lbs Bone Dust. 500 lbs Kainite.
" " 8—	500 lbs Cotton Seed Meal. 500 lbs Bone Dust.
9—	Nothing.
" " 10—	500 lbs Cotton Seed Meal. 500 lbs Floats. 500 lbs Kainite.
" " 11—	500 lbs Cotton Seed Meal. 500 lbs Floats.

12—Nothing.

" " 13— { 500 lbs Cotton Seed Meal.
500 lbs Ashes Cotton Hulls.
500 lbs Kainite. }

" " 14 { 500 lbs Cotton Seed Meal.
500 lbs Ashes Cotton Hulls. }

15—Nothing.

16—500 lbs Cotton Seed Meal.

17—500 lbs Acid Phosphate.

18—500 lbs Kainite.

19—Nothing.

The treatment of this plat was the same as others already given, except it was not laid by till July.

TABLE 11.

PLATS NOS. 4 AND 5—UNTILED AND TILED.

No. of Expt.	Manures Used Per Acre.	Yield per Acre in Tons.	Analyses. Degrees Baume.	Total Solids.	Sucrose.	Glucose	Purity Coefficient.	Glucose Ratio.	lbs available sugar upon 70 p c extraction Per ton	Per acr.	When Harvested	Remarks.
1	Untiled	18.92	8.4	15.26	12.20	1.06	80.26	8.60	148.44	2811.48	Nov. 30	
	Tiled	27.10	8.3	14.96	12.50	1.05	83.55	8.40	152.95	4144.94	"	
2	Untiled	25.00	8.2	14.86	12.50	1.05	84.12	8.40	152.95	3823.75		
	Tiled	26.64	8.5	15.46	11.40	1.30	73.73	11.40	132.30	3524.47		
3	Nothing	14.95	8.4	15.16	13.00	1.05	85.75	8.08	173.95	2600.55		
4	Untiled	23.26	8.6	15.56	12.40	1.00	79.68	8 03	152.60	3549.47		
	Tiled	26.14	8.2	14.86	12 00	1.05	80.75	8.75	145.95	3815.13		
5	Untiled	23.70	8.6	15.56	12.40	1.04	79.68	8.38	151.76	3596.71		
	Tiled	24.80	8.3	15.06	12.50	1.05	83.00	8.40	152.95	3793.16		
6	Nothing	14.26	7.9	14.26	12.50	1.09	87.65	8.72	152.18	2160.95		
7	Untiled	20.16	8.6	15.56	13.60	.80	83.55	6.15	165.20	3330.43		
	Tiled	21.64	....	......	......	....	......	......	......	....	....	Sample lost
8	Untiled	23.68	8.3	15.06	12.00	1.40	79.67	11.66	138.60	3198.88	Nov. 31	
	Tiled	24.60	8.3	14.96	12.70	1.05	84.89	8.26	155.75	3831.45	"	
9	Nothing	17.18	8.3	14.96	12.70	1.05	84.89	8.26	155.75	2675.78		
10	Untiled	15.94	8.7	15.76	12.30	1.00	78.04	8.13	151.20	2410.12		
	Tiled	26.36	8.3	15.06	13.00	1.00	86.32	7.69	161.00	4234.30		
11	Untiled	19.96	8.4	15.26	12.00	1.35	78.94	11.25	139.65	2787.40		
	Tiled	22.91	8.3	14.96	12.50	1.05	83.55	8.40	152.95	3504.08		
12	Nothing	14.86	8.6	15.66	13.90	.92	88.76	6.62	175.28	2604.66		
13	Untiled	15.10	8.5	15.37	13.40	1.30	87.83	9.70	160.30	2420.53		
	Tiled	23.54	8.9	16.17	14.70	.60	90.90	4.08	193.20	4549.92		
14	Untiled	17.84	9.	16.27	15.00	.90	92.19	6.00	191.10	3409.22		
	Tiled	20.06	8.4	15.26	12.80	.96	83.88	7.50	159.04	3190.34		
15	Nothing	13.78	8.6	15.57	12.90	1.04	82.20	8.06	158.76	2176.71		
16	Untiled	16.10	8.4	15.27	14.10	.65	92.33	4.61	183.75	2978.37		
	Tiled	20.10	8.2	14.87	13.60	.78	87.42	6.00	165.62	3328.96		

17	Untiled	12.00	7.8	14.17	11.10	1.04	78.33	9.37	133.56	1602.72	
	Tiled	15.92	8.3	14.97	13.00	.86	86.84	6.61	163.94	2609.92	
19	Untiled	13.98	8.5	15.34	13.35	.77	87.02	5.77	170.73	2386.80	
	Tiled	19.17	7.7	13.97	12.60	.93	85.89	7.75	148.40	2844.82	
18	Nothing	14.82	8.3	14.97	13.70	1.00	91.51	7.29	170.80	2531.25	

PLAT IV—UNTILED AND V TILED.

	UNTILED			TILED		
	Kainite		No Manure	Kainite		
No. of Experiment......	1	2	3	1	2	
Yield per acre in tons....	18.92	25.00	14.95	27.10	26.64	Cotton Meal
Total Solids..............	15.26	14.86	15.16	14.96	15.46	Acid Phosphate.
Sucrose...................	12.20	12.50	13.00	12.50	11.40	
Glucose...................	1.06	1.05	1.05	1.05	1.30	
lbs. av. sugar per acre....	2811	3824	2600	4145	3524	
No. of Experiment......	4	5	6	4	5	
Yield per acre in tons....	23.26	23.70	15.30	26.14	24.80	Cotton Meal
Total Solids..............	15.56	15.56	14.26	14.86	15.06	Orchilla
Sucrose...................	12.40	12.40	12.50	12.00	12.50	
Glucose...................	1.00	1.04	1.09	1.05	1.05	
lbs av. sugar per acre....	3549	3596	2161	3815	3793	
No. of Experiment......	7	8	9	7	8	
Yield per acre in tons....	20.16	23.68	17.18	24.64	24.60	Cotton Meal
Total Solids..............	15.56	15.06	14.96	....	14.96	Bone Meal
Sucrose...................	13.60	12.00	12.70	....	12.70	
Glucose...................	.80	1.40	1.05	....	1.05	
lbs. av. sugar per acre....	3330	3198	2676	....	3831	
No. of Experiment......	10	11	12	10	11	
Yield per acre in tons....	15.94	19.96	14.86	26.36	22.91	Cotton Meal
Total Solids..............	15.76	15.26	15.66	15.06	14.96	Floats.
Sucrose...................	12.30	12.00	13.90	13.00	12.50	
Glucose...................	1.00	1.35	.92	1.00	1.05	
lbs. av. sugar per acre....	2410	2787	2604	4234	3504	
No. of Experiment......	13	14	15	13	14	
Yield per acre in tons....	15.10	17.84	13.78	23.54	20.06	Cotton Meal.
Total Solids..............	15.37	16.27	15.57	16.17	15.26	Cotton Hull Ashes.
Sucrose...................	13.40	15.00	12.90	14.70	12.80	
Glucose...................	1.30	.90	1.04	.60	.96	
lbs. av. sugar per acre....	2420	3409	2177	4549	3190	
No. of Experiment......	16	17	18	16	17	
Yield per acre in tons....	16.10	12.00	14.82	20.10	15.92	
Total Solids..............	15.27	14.17	14.97	14.87	14.97	
Sucrose...................	14.10	11.10	13.70	13.60	13.00	
Glucose...................	.65	1.04	1.00	.78	.86	
lbs. av. sugar per acre....	2978	1603	2531	3329	2610	
No. of Experiment......	19	19	18	19	19	
Yield per acre in tons....	13.98	13.98	14.82	19.17	19.17	
Total Solids..............	15.34	15.34	14.97	13.97	13.97	
Sucrose...................	13.35	13.35	13.70	12.60	12.60	
Glucose...................	.77	.77	1.00	.93	.93	
lbs. av. sugar per acre...	2386	2386	2531	2845	2845	
			No Manure			

Nos. 16 is Cotton Seed Meal alone.
Nos. 17 is Acid Phosphate alone.
Nos. 19 is Kainite alone.

DEDUCTIONS FROM ABOVE.

Sett 1.	Tons.	lbs avai. sugar.
Increase Experiment 1 tiled over untiled	8.18	1334
" " 4 " " "	2.88	266
" " 7 " " "	4.48	——
" " 10 " " "	10.42	1824
" " 13 " " "	8.41	2129
" " 16 " " "	4.00	351
" " 19 " " "	5.19	459
Total	43.59	6353

Sett 2.	Tons.	lbs avail. sugar.
Increase Experiment 2 tiled over untiled	1.64	——
" " 5 " " "	1.10	197
" " 8 " " "	.92	633
" " 11 " " "	2.95	717
" " 14 " " "	2.22	——
" " 17 " " "	3.92	1007
" " 19 " " "	5.19	459
Total	18.04	3013
Less		519
		2494
Increase of 14 Experiments tiled over untiled	61.63	8858
Average increase per acre	4 40	633
Average increase 1st sett	6.23	909
Average increase 2d sett	2.58	357

Here the average increase of all the tiled over the untiled plats is at the rate of 4.4 tons of cane with 633 lbs available sugar per acre. Taking the 1st sett of untiled that furthest from the tiled and we have the increase 6.23 tons and 909 lbs available sugar which more nearly represents the true difference between tiled and untiled land, since the second sett runs within a few feet of the tiled land and the beneficial effects of the tiles are perfectly apparent both in the working of the land and the increase of crops. On this piece the difference between it and its fellow tiled, is only 2.58 tons and 357 lbs. available sugar.

EFFECTS OF TILE DRAINING

Are apparent not only in the increased yield, but in the improved tilth of the soil. In fact not only is the soil directly over the tiles improved, but the good effects are gradually extending laterally and even plainly visible this year in the outside rows of the adjoining plats. Plats IV and VII adjoin plats V and VI which are tiled drained. The experiments on the extreme left upon the former (2nd sett in above) and those upon the extreme right in the latter (basal mixture in the phosphoric

acid manures) were this year plainly influenced by the proximity of the tiles. So decided is their influence, that experiments of a manurial character cannot in the future be made upon them. It may be asserted with almost a certainty, that tiles properly laid will increase the crop fully $33\frac{1}{3}$ per cent in these black lands.

SUMMARY OF RESULTS.

1st. That the upper portion of the cane is the equal if not the superior to the lower part for seed, while the latter is much richer in sugar, suggesting the propriety of utilizing the upper thirds of the cane for seed and the lower $\frac{2}{3}$ of the entire crop for the manufacture of sugar.

2d. That two stalks of good sound cane properly planted in a well prepared seed bed is an abundance for maximum results. More than this if germination be good, may prevent that healthy suckering so essential to a full development of a cane plant.

3d. That seed from good first year stubble has given as good results the first year, as seed from plant.

4th. That a large application (3 tons per acre) of caustic lime seems to have increased the sugar in the cane.

5th. That stubbles (ratoons) come equally as well from the original sprouts as from suckers.

6th. That several foreign varieties of cane promise adaptability to our wants.

7th. That nitrogen in some form is needed by our soils to grow cane.

8th. That while nitrogen in the form of sulphate of ammonia has given slightly better results, no form of nitrogen appears to have a marked advantage over any other, thus enabling us to utilize our own cotton seed meal with the full assurance that it is the equal of dried blood, fish scrap, etc.

9th. That excessive quantities of nitrogen are injurious to the sugar content, and that 24 and 48 lbs. per acre are amounts suggested by experiments for best results.

10th. That nitrogen to produce the maximum results should be used in moderate quantities and properly combined with mineral manures.

11th. That mineral manures alone are without apparent ef-

tect, but combined properly with nitrogen are productive of the highest results.

12th. That phosphoric acid is needed by cane on this soil and is best supplied in soluble forms. The insoluble forms in floats and Orchilla guano, seems also after two years application to be highly available.

13th. That excessive quantities of phosphoric acid are not beneficial.

14th. That potash in small quantities is without visible results, the year it is applied, but used in excessive quantities for two years upon the same soil has given an increased tonnage of cane without altering its sugar content.

15th. That cane gives no preference for any form of potash.

16th. That excessive quantities of nitrogenous manures produce large tonnage with very low sugar content. (See Plat XV.)

17th. That an average crop of pea vines turned under, furnish to each acre about 56 lbs. nitrogen, 16 lbs. phosphoric acid and 92 lbs potash, quantities contained in 800 lbs. cotton seed meal and 640 lbs. kainite.

18th. That the roots of peas after the vines are removed, furnish plant food equivalent to about what is contained in 120 lbs. cotton seed meal and 130 lbs. kainite, and that their good effects when turned over without vines must be traceable rather to mechanical than chemical properties.

19th. That draining the land by tiles has increased both the tonnage and available sugar; this year the increase is calculated at about 33⅓ per cent.

20th. That the effects of tiles are plainly discernible in the plats adjoining those tiled, for distances equalling 20 feet.

Applying the above deductions, the Station would suggest that manuring should be intelligently done with reference to both the soil and the cane. If the cane is grown for the mill a fully matured stalk is desired, which cannot be obtained by excessive manuring. If grown for seed, high fertilization is permissible but not advisable.

If the soil be in good tilth and rich in vegetable matter. less nitrogen and more mineral manures are suggested. Such is usually the case with new ground and where a heavy coat of

pea vines has been turned under. If the soil be fair both in tilth and organic matter, then the nitrogen and mixed minerals should be used in such a proportion as to afford a slight excess of phosphoric acid over nitrogen. If the soil has been worn by continuous cropping in cane, then nitrogen should equal phosphoric acid, such obtains usually with stubble and succession cane.

It is therefore safe to recommend for new ground, pea vines fallow, etc., a manure containing one part of nitrogen to four parts of phosphoric acid, a mixture of one part of cotton seed meal to two of acid phosphate fills this requirement.

For fair soils the nitrogen should be to phosphoric acid as 1 and 2. Such is found in an equal mixture of cotton seed meal and acid phosphate.

For stubble and succession lands the nitrogen may equal or even exceed the phosphoric acid. Two parts of cotton seed meal to one part of acid phosphate supply these ingredients in about equal quantities. Three parts of the former to one of the latter may sometimes be used with excellent results.

Instead of cotton seed meal the other forms of nitrogen may be used with equal prospects of success.

The above mixtures usually produce the best results when used in quantities not exceeding 800 to 900 lbs. per acre. It is believed that a good crop of cane with good seasons, well and early cultivated, can appropriate about these quantities of manure by the 1st or middle of September, at which time it is desirable that its growth should be arrested in order that maturation may begin.

SUGAR HOUSE AND LABORATORY EXPERIMENTS.

Pending the issuance of a Bulletin containing the record of work in the sugar house, the following announcements of results may not be inappropriate in this Bulletin. Mention has been made in this Bulletin of the superior content of sugar in the lower portion over the upper part of the stalk of cane. Numerous experiments have been made to test this. The following are selected to illustrate this truth.

Experiment No. 1. A stalk 8.17 feet long was divided into

4 parts of equal lengths. Each part was weighed, passed through a mill, and bagasse weighed. The juice was also caught and carefully analysed. The following are the results:

No. of Part.	Per Cent. of Stalk.	Weight before crushing in grams.	Weight of Bagasse in grams.	Weight of juice in grams.	Per centage extraction.	Analysis. Total Solids.	Sucrose.	Glucose.	Grams avail'. sugar
Top, upper fourth........	20.	587.7	235.9	351.8	59.86	11.3	8.5	1.12	23.29
Next to upper fourth.....	24.	694.2	234.05	460.1	66.29	15.4	12.5	.80	51.99
Next to lower fourth......	27.5	803.0	256.50	546.5	68.06	16.3	13.5	.78	67.38
Butt or lower fourth......	28.5	820.5	268.90	551.6	67.23	16.7	14.8	.64	76.34

Here the upper fourth which is about 20 per cent. by weight of the stalk, gave 23.99 grams of available sugar out of a total of 220 grams, or about 11 per cent. Again the per centage of extraction was also considerably below the others.

Experiment No. 2. Another stalk 7 feet 4 inches long was also cut into four parts of about equal lengths, the juice carefully weighed and analyzed. The following are the results:

No. of Part.	Weight of juice in grams.	Per cent extraction.	Analysis. Total Solids.	Sucrose.	Glucose.	Grams avail. sugar.	avail'ble sugar per ton. Per cent.	Pounds.
Top, upper fourth..................	343.2	67.57	14.6	11.2	1.03	32.7	6.4	128
Next to upper fourth..............	415.6	71.37	16.6	14.5	1.00	54.	9.27	185
Next to lower fourth................	360.3	71.70	16.6	15.0	.86	49.4	9.80	196
Next to lower fourth................	411.2	70.16	17.1	15.3	.75	58.3	10.00	200

The average of all per ton is ....177 lbs. available sugar.
Without the top or upper fourth...................194 " " "
Without the upper half...........................198 " " "
Without the upper three-fourths...................200 " " "

Here the upper fourth representing about 23 per cent. in weight of entire stalk, gave only about 11 per cent. of the available sugar. Nothing more clearly shows that the upper fourth is decidedly inferior to the rest of the stalk in sugar content.

ANALYSIS OF A STALK OF CANE.

A stalk of cane was split its entire length. The first half was run through the mill and the juice and bagasse analyzed separately. The second half was analyzed as a whole. The following are the results:

Mill Extraction gave for the 1st Half—

Juice	76.32 per cent.
Bagasse	23.68 per cent.

ANALYSIS.

	Total solids.	Sucrose.
Juice	15.9	13.4
Bagasse	44.96	9.28

Therefore we have in 100 parts of the cane:

Water in juice	64.17	Sucrose in juice	10.21
Water in bagasse	13.10	Sucrose in bagasse	2.21
Total in cane	77.27	Total in cane	12.42

The second half gave by direct analysis:

Water	77.13 per cent.	Sucrose	12.47 per cent.	Fibre	8.39 p. c.
Ash	.62 " "	Glucose	.70 " "	Total sol.	22.87 p. c.

Therefore we have for 100 parts of cane:

	Water.	Sucrose.	Glucose.	Fibre	Ash	Oth. Sol.
1st half	77.27 p c	12.42 p c	—	—	—	
2d half	77.13	12.47	.70	8.39	.62	.69
Average	77.16	12.45	.70	8.39	.62	.69

And this may be taken as a fair analysis of Louisiana plant cane.

METHODS OF CLARIFICATION.

The following were used: 1st, lime alone; 2nd, sulphur and lime; 3d, bisulphite and lime, and 4th, Tannic extract and lime.

These were used under varying conditions. An open pan was used to concentrate in this year and a loss always occurred by inversion during concentration. When lime was used alone or with Tannic extract the inversion was the least, in fact very little. With sulphur and bisulphite, there was always inversion increasing just in proportion to the acidity of the clarified juice. It is of the utmost importance when these reagents are used, that the juice be made as nearly neutral as possible with lime before concentrating.

The bisulphite above was kindly donated by Mr. H. Bonnabel, of New Orleans. The Tannic extract was donated by Mr.

Frank Ames, of Boston, the owner of the fine sugar plantation (Milladen) opposite New Orleans. This extract costs in Boston five cents a pound and this quantity clarifies 200 gallons of juice. Samples of the sugars and molasses made by this process have been carefully preserved for future examination. The scums and settlings from Tannic extract were easily filteered and the cakes made, are to-day perfectly sound, showing no sign of fermentation, while those made otherwise have long since whitened with decomposing matters. The filter press made by Posey & Jones, and kindly lent the Station was again used this year to demonstrate the loss occasioned by the wasteful process of throwing the scums and settlings in the ditch.

EXPERIMENTS WITH DECOLORIZING AGENTS.

Kleeman's process of filtering juices and scums was frequently tried during the season, using two varieties of German lignite, Alabama lignite and charcoal.

Both the scums and whole juices were each separately tried with the above lignites, treating them successively, acid, neutral and alkaline. The per centage of each lignite to the juice used most desirable for good work, was also determined. Both the German and Alabama lignite filtered well and strongly decolorized, preference being given by all present to the latter. Charcoal was very inferior. The best work was accomplished with 5 lbs. lignite to 30 gallons of juice. Alabama lignite was successfully used also in brightening black molasses.

Ten tons of this Alabama lignite has been donated for filtering purposes on a large scale to parties in New Orleans, and hopes are entertained of its successful introduction into the sugar industry of Louisiana.

Full details of above experiments will be given in our Bulletin on the sugar house.

CONCLUSIONS.

In the last quarter of a century wonderful progress has been made in machinery for making sugar, so that the yield per ton of cane has been gradually increasing until to-day the startling announcement is made that by diffusion upon Magnolia

plantation 231 lbs. of sugar per ton of cane has been obtained. Such progress in a few years is almost incredible. The open kettle has been supplanted by the vacuum strike pan; the centrifugal purges in a few moments and in a much more satisfactory manner, the masse cuite that once drained for weeks in the purging. The evaporation "in vacuo" by the simple, cheap, and economical double, triple or quadruple effect, is as far superior to the open pans, as this is to the iron kettle. The three roller mill banished the two vertical rolls, to be in turn overshadowed by the five roller. Even these, with a shredder attachment, is now subordinated in its efficiency to the diffusion cells, a recognition of the superiority of chemical effect over mechanical power.

Such has been the marvellous march of mechanical improvement in the manufacture of sugar. Has the agriculture of sugar kept pace with its mechanics! By no means! The reasons for this, numerous and incontrovertible, need not be given here. Suffice to say, that in the next quarter of the century a large portion of our time must be devoted to an education of the cane plant. It must be sent to school and be made to imbibe in large quantities those ingredients which shall cause its cells to distend with saccharine life. The action of manures, the functions of the soil, the differentiation of varieties, and the vicissitude of the seasons, must engage the intelligence of our planters. In the field and in the laboratory must be the work of those who wish to advance the science and art of successful sugar growing in the next generation. It is therefore with pardonable pride that this Station presents this Bulletin to the public, the record of the first systematic work in the agriculture of sugar cane done in Louisiana, and invites a careful perusal of its contents, and such an earnest moral and pecuniary support as to enable it to amplify its work and extend its investigations.

RECORD OF WEATHER LOUISIANA SUGAR EXPERIMENT STATION, FOR JULY 1887.

Date.	TEMPERATURE.					Rainfall.
July.	9 A. M.	3 P. M.	9 P. M.	Maximum	Minimum.	Inches.
1	82°	75°	75°	82°	70°	3.29
2	80	80	—	80	71	.80
3	81	80	79	92	68	
4	85	82	78	92	72	
5	87	88	80	94	73	
6	84	81	78	92	74	.33
7	85	86	77	92	73	.61
8	83	88	79	92	74	
9	85	91	81	92	74	
10	87	80	—	93	76	
11	86	89	76	94	74	
12	87	81	80	94	71	.09
13	87	82	77	89	72	.09
14	86	83	76	93	71	.33
15	85	85	80	93	71	
16	85	90	86	91	73	
17	85	86	80	95	76	.10
18	86	87	78	95	73	
19	88	92	82	93	76	
20	89	92	79	95	77	.10
21	85	78	78	93	77	.92
22	85	89	82	93	75	
23	83	84	79	93	75	.13
24	88	78	76	93	74	.46
25	84	87	78	93	72	
26	83	75	76	88	72	.31
27	82	90	83	91	72	
28	87	89	84	96	76	
29	90	92	85	95	77	
30	89	85	80	97	74	.30
31	89	92	84	94	76	
Average.	85.4	86.7	79.4			7.86

Maximum temperature 97°
Minimum temperature 68°

Daily rainfall .253

RECORD OF WEATHER LOUISIANA SUGAR EXPERIMENF STATION FOR AUGUST 1887.

Date.	TEMPERATURE.					Rainfall.
August.	9 A. M.	3 P. M.	9 P. M.	Maximum	Minimum.	Inches.
1	83°	78°	77°	91°	79°	.65
2	86	85	82	92	72	
3	89	83	80	95	76	.17
4	88	83	83	93	73	
5	81	76	76	89	77	1.67
6	84	79	76	91	73	.58
7	86	89	81	93	74	
8	86	89	81	95	74	
9	83	79	82	91	74	.40
10	88	75	73	86	73	.44
11	83	84	78	89	70	.49
12	84	88	81	89	72	
13	84	87	77	91	72	
14	84	86	80	89	70	
15	84	89	79	90	70	
16	84	84	80	90	72	
17	84	81	79	91	74	.25
18	84	86	80	89	75	
19	81	89	80	90	75	
20	84	88	—	—	75	
21	85	84	80	92	75	
22	85	90	82	92	71	
23	87	93	81	94	76	
24	84	89	81	90	75	
25	85	93	78	93	74	1.43
26	84	88	77	90	74	.5
27	77	83	75	83	74	
28	81	83	74	83	70	
29	80	85	74	86	69	
30	80	84	76	85	70	.12
31	78	82	74	82	72	——
Average.	84	85	78.4			6.70

Maximum temperature 95° Daily rainfall .216.
Minimum temperature 69°

RECORD OF WEATHER LOUISIANA SUGAR EXPERIMENT STATION FOR SFPTEMBER 1887.

Date.	TEMPERATURE.					Rainfall.
September	9 A. M.	3 P. M.	9 P. M.	Maximum	Minimum.	Inches.
1	80°	82°	73°	83°	70°	
2	81	83	71	85	68	
3	80	86	74	86	67	
4	80	87	74	87	67	
5	81	86	75	86	67	
6	81	83	71	86	66	
7	83	89	76	89	66	
8	83	91	77	91	74	
9	81	92	80	92	69	
10	82	92	82	92	74	
11	85	92	83	92	74	
12	85	84	78	88	75	.47
13	78	86	76	89	70	
14	81	87	75	87	70	
15	82	90	78	90	71	
16	83	91	77	91	73	
17	80	89	77	89	72	
18	76	79	77	79	72	.62
19	76	75	73	79	71	1.62
20	73	79	75	79	71	.29
21	75	81	77	81	71	
22	82	86	80	86	74	
23	80	86	75	86	69	
24	72	77	67	77	66	
25	70	80	68	80	60	
26	70	77	74	80	64	
27	70	79	69	80	67	
28	70	75	64	75	62	
29	69	75	63	76	57	
30	70	79	63	79	56	
Average.	78	84	74			3.30

Maximum temperature 92°
Minimum temperature 56°

Daily rainfall .11

RECORD OF WEATHER LOUISIANA SUGAR EXPERIMENT STATION, FOR OCTOBER 1887.

Date.	TEMPERATURE.					Rainfall.
October.	9 A. M.	3 P. M.	9 P. M.	Maximum	Minimum.	Inches.
1	74	80	73	80	57	
2	70	80	74	83	60	
3	77	84	74	84	69	
4	80	83	73	84	70	
5	75	82	74	82	65	
6	80	85	74	85	65	
7	78	81	73	82	65	
8	81	85	73	85	65	
9	81	86	73	86	66	
10	82	83	73	85	66	
11	74	70	66	76	70	
12	57	66	59	66	54	
13	62	71	65	73	54	
14	68	76	65	76	58	
15	71	77	71	77	57	
16	70	76	65	76	61	
17	72	..	71	81	..	
18	72	..	71	81	..	3.2
19	72	..	68	82	61	3.
20	70	76	67	76	61	.06
21	63	69	60	69	61	
22	62	..	59	70	55	
23	71	79	68	79	56	
24	..	84	74	84	63	
25	77	63	59	74	65	.07
26	58	60	58	60	54	.06
27	60	63	62	63	56	
28	63	66	60	66	58	
29	62	72	..	72	54	
30	52	55	47	55	49	
31	..	..	52	60	40	
Average.	67.8	75	65.7			6.39

Maximum temperature 86°
Minimnm temperature 40°

Daily rainfall .206

RECORD OF WEATHER LOUISIANA SUGAR EXPERIMENT STATION FOR NOVEMBER.

DATE.			Rain Fall.
November.	Maximum	Minimum	Inches
November 1	74	42	
" 2	70	42	
" 3	70	44	
" 4	72	46	
" 5	71	45	
" 6	....	53	
" 7	75	53	
" 8	69	64	
" 9	69	64	
" 10	71	64	
" 11	73	49	
" 12	73	39	
" 13	73	....	
" 14	....	50	
" 15	78	52	
" 16	77	50	
" 17	77	50	
" 18	61	59	
" 19	64	52	
" 20	70	....	
" 21	....	30	
" 22	71	....	
" 23	76	55	
" 24	77	56	
" 25	76	59	
" 26	78	60	
" 27	80	60	.11
" 28	59	44	
" 29	60	37	
" 30	62	44	
			.11

Maximum 80°
Minimum 30°
Daily Rainfall .003.

RECORD OF WEATHER LOUISIANA SUGAR EXPERIMENT STATION FOR DECEMBER 1887.

December Date.	TEMPERATURE.					Rainfall.
	9 A. M.	3 P. M.	9 P. M.	Maximum	Minimum.	Inches.
1	57	61	52	61	44	
2	63	70	66	70	55	
3	71	76	66	76	63	
4	72	77	62	77	60	.91
5	59	65	57	65	57	
6	57	69	62	69	50	
7	70	71	66	76	60	.66
8	63	64	55	64	60	
9	60	60	52	60	52	
10	54	60	50	61	43	
11	57	64	56	64	43	
12	54	55	51	55	51	
13	54	60	..	60	45	1.42
14	55	56	56	56	52	
15	56	59	55	59	53	.16
16	50	58	50	58	42	.24
17	44	47	42	47	36	
18	51	58	40	60	45	
19	55	61	53	61	49	.94
20	53	58	47	..	36	
21	38	41	40	41	33	
22	36	40	40	41	55	.95
23	43	44	42	44	39	1.86
24	40	43	40	43	33	
25	43	46	..	48	39	
26	48	61	..	63	40	
27	47	65	63	67	45	
28	48	51	40	51	30	
29	35	43	40	43	34	
30	42	52	59	71	39	
31	71	72	66	73	49	
Average.	53.2	58.3	52.4			7.14

Maximum temperature 77°
Minimum temperature 30°

Daily rainfall .23°

CONDENSED WEATHER RECORD OF SUGAR EXPERIMENT STATION FOR THE YEAR, 1887.

MONTH	Average Temperature	Maximum Temperature	Minimum Temperature	Rainfall in Inches.
January	57°	82°	22°	3.31
February	65.4	80	30	5.23
March	58.2	81	40	3.27
April	71.7	89	57	2.21
May	78.	94	59	6.56
June.................	84.	94	62	10.35
July	84.	97	68	7.86
August..............	82.5	95	69	6.70
September	79.	92	56	3.30
October.............	69.5	86	40	6.39
November...........	60.	80	30	.11
December	54.6	77	30	7.14

Average Temperature for the year......70.3°
Maximum " " " " ......97°
Minimum " " " " ......22°
Total Rainfall " " " ......62.43 Inches.

RICE.

BULLETIN No. 15.

OF THE

LOUISIANA SUGAR EXPERIMENT STATION

KENNER LA.

Wm. C. Stubbs, Ph. D.,

—DIRECTOR—

—ISSUED BY—

THOMPSON J. BIRD,

COMMISSIONER OF AGRICULTURE, BATON ROUGE, LA.

BATON ROUGE:

PRINTED BY LEON JASTREMSKI, STATE PRINTER,

1888.

SUGAR EXPERIMENT STATION,
KENNER, LA.,

Maj. T. J. Bird, Commissioner of Agriculture, Baton Rouge, La.:

Dear Sir—I hand you herewith Bulletin No. 15, covering a few experiments made in Rice upon the plantation adjoining this Station, owned by Mr. Wilkinson. I also include a valuable paper on Rice, read before the Jefferson Agricultural Association by this same gentleman.

Respectfully,

WM. C. STUBBS, Director.

RICE.

The Botanical name for our common rice is "Oryza Sativa." The word oryza was coined by the Greeks from the Asiatic word *eruz*, and our modern nations have modified it into rice, riz, and reis. There are four species of rice described by botanists, though it is probable that they are only varieties. Oryza Sativa our common rice, Oryza Mutica, Dry or Mountain rice, Oryza Praecox, Early rice and Oryza Glutinosa, Clammy rice. The common rice is the only one grown in Louisiana, so far as the writer's information goes. The antiquity of rice is very great as the origin of its name indicates; and its native habitat is unknown. It is cultivated largely in India, China and Japan and also sparingly in Europe, In Carolina it has long been a staple commodity, its introduction into this State being made as far back as 1698, "by a small bag of paddy given as a present from Dubois, treasurer of the East India company to a Carolina trader." It is also said that a Dutch vessel from Madagascar brought rice subsequently to the same State and to this is attributed the presence of two kinds there now. It is said that there is a mountain rice growing in Java and Cochin China called "Paddy Gummy," which thrives in dry light soils, even growing upon the Hima layan mountains up to the snow edge, requiring no more moisture than the usual rains, which are not frequent during the season of vegetation. If this be true it may be expected that this rice will prove a valuable acquisition to the upland cultivators of this cereal.

The following admirable paper read before the Jefferson Agricultural Society by one of the best and most intelligent rice planters in the State, Mr. H. S. Wilkinson, of Jefferson parish is herein inserted without apology, for the benefit of the rice planters of the State.

ESSAY READ BEFORE JEFFERSON PARISH AGRICULTURAL ASSOCIATION BY H. S. WILKINSON.

The rice crop first assumed noticeable proportions in this

State, when the abandoned plantations after the war, suggested the possibilities of rice growing on a large scale, and the success attending the first enterprising ventures caused others to follow, until it is to-day, one of the large industries. The plan adopted by the leaders in this industry, and which has been closely followed by their successors as long as the new plantations lasted, was to lease the land for 2 or 3 years, at first 3 years was the limit, after this the plantation was abandoned and a new one leased. This abandonment of valuable land was not owing to any want of fertility, but because the methods used in growing the crop, were just what were required to develop the water grasses, the seed of which, are not only in the land, but are added to each year, in the water we use for irrigation after the harvest the lands were allowed to remain in whatever condition they happened to be in, ditches filled up, etc., until another season opened. It took only a few years of this treatment to get the field so foul with grasses, that it was impossible to make a profitable crop. The supply of new land being now exhausted, the rice grower—I use the word grower advisedly—has now to learn how to deal with the double difficulty of cleaning his land, that is getting rid of these grasses and restoring it to its original fertility, as it has undoubtedly been impoverished by constant cropping and neglect. While the attempts to get rid of grass have only secured failures, enough has been found out to permit me to say that it can be thinned out considerably, but from the variety we have to contend with embracing as they do, seed that germinate in February to seed that germinate in June, it is hardly possible. under the present methods to destroy it entirely. The principal source of supply for these grass seed comes from the suckers that shoot out from the old stalk, which is cut with the rice. In 15 days after a field is cut, these suckers, which grow with wonderful rapidity, are "in seed" again. I have met with some success in destroying this supply, by following up the harvester with a mowing machine, cutting everything down, allowing it to dry and then burning it. To do this enough time must elapse before the mowing machine is started to allow the sucker to send out new leaf, so that when cut there will be enough straw on the ground to burn. Mowing without burning is almost useless, the fire is what does the work, destroying not only the seed but the root itself, thus effectually preventing any further suckerings, any seed that are left by the fire are exposed and will germinate during the first warm wet spell, and be destroyed by the first frost. A great objection to this plan is that it leaves the land perfectly bare, to be impoverished by the parching August and September sun, and baking it so hard it is difficult to plow it. This objection would condemn it as a practical failure, and we have yet to find out some better plan of destroying this supply of seed, before we can ever hope to succeed in establishing permanent rice plantations. If these grass seed are not des

troyed in the fall, they are scattered broadcast by the wind, protected from heat and cold by the luxuriant growth and only germinate when the continuous warmth of spring, penetrating the ground, causes all vegetation to start. I thought these seed might be destroyed in winter, by keeping them under water, and on one occasion, having a place well located for that purpose, I kept a field under water all winter, when it was drained in the spring for plowing; the straw, and in fact, all vegetable matter had rotted, leaving the land perfectly clean, but a few days exposure to the sun brought out a first class stand of grass. They will not *rot* without germinating, and they will not germinate in cold water. Having thus seen, that by the methods suggested these seed cannot be destroyed profitably before spring, the best plan to adopt will be to burn off, as soon as possible after the grass is killed by *ice*, by this means, some of the seed are destroyed by fire, some by ice, and the balance being exposed, will feel the warmth much earlier, and will germinate in time to be destroyed by plowing, *provided* the plowing is delayed long enough. This method is almost as objectionable as mowing and burning in the fall, as the plowing ing is delayed until March, the planting is late, and all the benefit of the August market is lost, but it is still in my opinion, the most advantageous plan. The grass seed are in the ground, producing a hardier and more prolific plant than rice. The man who calculates they will not come up, finds out his mistake too late to remedy it, except at considerable cost. *Hand-weeding* is out of the question, being too slow and expensive for the large planter. One of the great advantages of hand-weeding consists in pulling the grass up by the roots, which, while it effectually destroys the grass, loosens up the land, and when properly done is equivalent to a thorough working. This requires considerable slight of hand and care, and is a kind of work that cannot be gotten out of inexperienced hired labor. Rice comes nearer to being a cultivated crop in the lower part of Plaquemine parish than in any other part of this State. It is claimed down there, that rice never thrives until after it is weeded, and we can readily see the reason, for in tearing up these roots, the land is loosened, and put into such a condition that the rice roots can penetrate and furnish the plant with a bountiful supply of nutriment. But this kind of cultivation is too expensive for the large planter, and *his* only resource, if caught with a grassy crop, is to scythe everything, and trust to the rapid growth of the rice, to smother out its slower growing rivals. This it generally does, but its race for life absorbs all of its energies, gives it no time to sucker, and thus materially reduces the yield. When our lands were new, 15 bbls. to the acre, was about an average yield on a large place, while now we consider 10 bbls. to be about the standard.

This great falling off in a few years, is not owing so much to the exhaustion of the soil, as it is to the grass crop, we raise

with our rice, which chokes out the stand, and prevents what is left from suckering, and to the neglect of drainage in the fall and winter. As I stated before the most successful means I have used for keeping my field clean, is to burn off early, and let the grass come up before plowing. If a "clean stand" can be secured, it will not be necessary "to scythe," as the few weeds, &c., can be cut out with a cane knife, the crop can be harvested fully two weeks earlier and a better yield obtained. While grass is the first and principal difficulty a rice planter has to overcome, to insure a good yield, he must have a good healthy growth, and this cannot be obtained unless the land is in such a condition that the roots may develop. It is about as difficult to get rice land in this condition, as it is to get it clean, but thorough drainage in the fall and winter, and in fact at all times except when water is necessary for irrigation, will help it, and is absolutely necessary. Our low swampy lands, that are constantly under water become soft and and remain so, but the bulk of the rice crop is produced on what we call high land, the water does not lay on it long enough to soften it, and there is as much difference between drained and water soaked rice lands, as between drained and water soaked cane lands. If thoroughly drained, rice lands when plowed, and are allowed to remain long enough, *will* pulverize and keep in good condition until continuous irrigation settles it down, but water sobbed land, it you ever succeed in pulverizing it, will be run together by the first rain, and get as compact as ever. The water may penetrate through it after irrigation commences, but will never soften it sufficiently for the root of any plant raised for the benefit of man, to get much out of it. Land should be well plowed, and as deep as possible. We have seen from the experiments made by Prof. Stubbs, that cane roots did not penetrate below the depth that the land was plowed; how much more would this apply to rice roots, which have to eke their subsistance out of land abused from the time it is first turned into a rice field. A plentiful and fresh supply of water is also indispensible, and in summer the deeper it can be got the better the plant thrives. The constant hot sun heats it, so that while the plant is not exactly scalded, it does not thrive, and the temperature can only be kept down by running in a fresh supply.

While fall plowing is advantageous in turning the land up, and giving it chance to drain, it is equally disadvantageous in covering up not only the grass seed, but the shattered rice, and protecting it through the winter. I have tried this repeatedly with 4 horse plows, and failed in every instance to derive any benefit. It seems to me, however, if we could obtain the yield from oats, reported by the Sugar Experiment Station that the best method of keeping our rice lands in good condition, would be to plant them in oats in October. This could easily be done and the crop harvested in time to be followed by rice—sometime in May—even if the oat crop only paid expenses, the difference

in the yield of rice would pay a profit over the possible increased expense of artificial irrigation. The same condition that produce the germination of oats, would bring out the grass and shattered rice, while the fall plowing and drainage necessary for oats would give the land a chance to dry. Or even if the whole field could not be planted in oats, one-half, or one-third, would enable a planter to clean his field thoroughly every three years, keep his land up to the standard of excellence, and give a permanent crop, in place of what is now simply a speculation.

METHODS OF PLANTING.

The method of planting pursued in Louisiana, is to sow the rice broadcast, using from 1 to 3 bushels per acre upon well prepared lands and harrow in, the ground being prepared with ditches and embankments for inundation at will. It is sown from March till June. The methods of flooding after the rice is sown vary with different planters. Some flood immediately after planting, letting the water barely cover the ground, withdrawing it as soon as the grain begins to swell. Some permit the rice to germinate thoroughly without water. While others even sprout the seed (by soaking bags of rice in ponds of water) before scattering it broadcast over the land, which is shallowly covered with water. It is aftewards covered with a large wooden harrow with very short wooden teeth. All flood when the rice has attained a height of three or four inches, leaving the top leaves a little above the water. The water is kept on the rice until a short time before harvest when it is withdrawn to give the stalks strength and to dry the ground for the convenience of the reaper.

UPLAND RICE.

Like other cereals, rice adapts itself to the soil, climate and mode of cultivation. Therefore all varieties of rice can be grown on uplands, while all have been found to succeed best when inundated, No variety has yet been discovered which yields as much out of the water as it does in it. Small crops of upland rice are grown in the piney woods of Alabama, Mississippi and Louisiana, not for profitable export, but for furnishing a home supply of a healthy and nutritious food. It is planted in rows and cultivated with plow and hoe. A variety with a long grain

and red chaff is said to succeed best on uplands. There is an increasing tendency to grow upland rice and at the solicitation of many farmers, the Station will next year conduct a series of experiments in upland rice, to test the manurial requirements of this crop as well as the best modes of cultivation.

DISEASES OF RICE.

The only disease which has been noted by writers on rice, is a blight or failure of the head to fill with grain; this is called *brusone* and is usually prevented by changing seed. The real cause is unknown. In Louisiana it frequently occurs on first year new ground.

USES OF RICE

Rice is largely used as an article of food in India and China, and is daily on the table of the Carolinian and Louisianian, who constantly extol it as superior to other vegetables. Elsewhere in the United States it is used only to a limited extent, either as a diet for invalids or as an ingredient of pastry, to be served with condiment, spices and fruit. It has been suggested that it would be to the interest of the rice planter, to send agents to the Western and Northwestern fairs and expositions who would teach the visitors the peculiar method of cooking rice, making each grain stand off to itself, instead of the usual glutinous mass found on northern tables, and thus by making it palatable to the taste, enhance consumption and demand.

MANURES FOR RICE.

Rice is not a great impoverisher of the soil, especially if the straw and chaff were regularly returned to it. To find out the manurial requirements of this cereal, this Station has been for two years past, conducting a series of experiments upon the adjoining plantation of Mr. H. S. Wilkinson, who kindly placed his land at our disposal and aided us in their conduct.

Exactly how to apply manures to rice, in order that they may accomplish the greatest good possible, when the rice is soon to be inundated, is yet an unsettled question. For the past two years the various fertilizers have been scattered broadcast over the soil before being broken. The soil was then in-

verted, harrowed, and rice sown. This mode of application has not been satisfactory, the increased results, while sometimes apparent, were not large. Last year by a misunderstanding, the plowman inverted one plat before we reached it with manures. Accordingly in this No. 8 the increase was quite satisfactory and has perhaps furnished a key to the successful method of application of all manures.

EXPERIMENTS IN RICE MADE ON ADJOINING PLANTATION OF H. S. WILKINSON—SEASON 1887.

No. of Expt.	Manures Used Per Acre	Yield Straw Per Acre.	Yield of Rough Rice Per Acre.	Barrels of 162 lbs. Per Acre.
1	No manure.............	2896 lbs	1500 lbs	9.26
2	300 lbs. Cot. Seed Meal..	30[illegible]6	1515	9.35
3	150 lbs. Acid Phosphate	2050	1296	8.00
4	300 lbs. Cot. Seed Meal 150 lbs. Acid Ph'sphate	2872	1236	7.63
5	No manure.............	2802	1379	8.51
6	300 lbs. Cot. Seed Meal 50 lbs. Kainite	Lost	Lost	
7	150 lbs. Acid Phosphate 50 lbs. Kainite	2724	1254	7.74
*8	300 lbs. Cot. Seed Meal 150 lbs. Acid Ph'sphate 50 lbs. Kainite.......	4017	2082	12.85
9	No manure.............	2730	1271	7 84

*This manure was spread on the surface of the plowed ground just before harrowing in the rice—the others were spread on the ground before being broken by the plow.

REMARKS ON ABOVE.

Manures mixed April 18th and 19th, and put out 21st. Manures applied before the land was plowed, except No. 8, which was plowed but not harrowed. Rice sown April 21 and 23.

Nos. 1 and 2, cut August 31st.

Nos. 3, 4 and 5, cut September 1st.

No. 6, cut September 2nd.

No. 7, cut August 31st.

No. 8, cut August 29th.

No. 9, cut August 30th.

Nos. 4, 5, and 6, were thin stands, the others good.

In the above experiments all the fertilizers except No. 8, seemed to have been placed too low in the soil, beyond the reach of the fibrous surface roots of rice.

Only on No. 8 were the results at all satisfactory, and here alone was the fertilizer applied near the surface. This fertilizer gave an increase of 5 barrels of rice over its neighboring unfertilized plat, No. 9.

Advantage being taken of the results of this crop, next season our experiments will be directed with more intelligent ideas of the needs and necessities of this plant.

CONCLUSIONS.

At present, the Station is unable to positively recommend any fertilizer for rice, but from the experience of several planters together with deductions drawn from its own results, it is inclined to suggest that a mixture of two parts of Cotton Seed Meal and one part of Acid Phosphate, mixed and applied broadcast upod the land just before the rice is harrowed in, will meet the requirements of this plant on black lands. On sandy lands Kainite may be added at the rate of 200 lbs. to the ton of above mixture.

POTATOES, TOMATOES, PEAS

—AND—

SMALL GRAINS.

BULLETIN

No. 16,

OF THE

STATE EXPERIMENT STATION,

BATON ROUGE, LA.

WM. C. STUBBS, A. M. PH. D.,

DIRECTOR.

—Issued by—

THOMPSON J. BIRD,

COMMISSIONER OF AGRICULTURE,

BATON ROUGE, LA.

BATON ROUGE:

ADVOCATE STEAM BOOK AND JOB PRINT.

1888.

BATON ROUGE, LA., October —, 1888.

HON. T. J. BIRD, Commissioner of Agriculture. Baton Rouge:

DEAR SIR—I hand you herewith the report of Mr. D. N. Barrow, my assistant at the State Experiment Station, Baton Rouge, giving results of experiments made during the year in Potatoes, Small Grain, Tomatoes, Peas, etc. As remarked by him, the conditions this year, both as to soil and seasons, have been very unfavorable. Yet the results are deemed of sufficient importance to constitute Bulletin No. 16, which you are requested to publish as such.

Respectfully submitted,

WM. C. STUBBS,
Director.

STATE EXPERIMENT STATION,
Baton Rouge, La., September —, 1888.

Dr. Wm. C. Stubbs, Director:

DEAR SIR—In accordance with your request, I herewith hand you the results of crops harvested on this Station. The low yield of all is due to the fact that during most of the month of April and a part of May there was scarcely a drop of rain—just the time when these crops needed rain most.

Very respectfully,

DAVID N. BARROW,
Assistant Director.

REPORT.

POTATOES (*Solanum Tuberosum*).

No experiments were made in fertilizing, our energies all being directed towards determining the variety or varieties best suited to this soil and climate. As this is impossible from one year's results, the culls of each variety have been carefully kept separated and preserved. These will be planted for a fall crop, the product of which will be saved for the purpose of repeating the experiments next Spring.

SOIL—ITS PREPARATION, LOCATION, ETC.

The plat selected for the Potatoes was situated on top of a hill, perfectly level and well drained. It measured forty-five feet in width by one hundred and fifty-seven in length. The soil is a clayey loam, of a deep red color and inclined to puddle. The whole hill on which the plat is situated had been in commons for years, and had been heavily depastured by the stock of Baton Rouge, and greatly impoverished.

The sod was inverted the first of February of this year, with a two-horse sulky plow, cross plowed with a one-horse turn plow, harrowed, and laid off cross-wise in three and one-half feet rows, with one-horse turn plow. Three rows were devoted to each variety—equal to one-eightieth of an acre.

SEED—PREPARATION AND PLANTING.

The seed potatoes, cut in the usual way, to pieces with two to three eyes, were dropped in an open furrow eight to ten inches apart, on February 6th, and lightly covered. No manure was used, and the turf prevented that pulverization of soil so essential to this plant.

SEASON, CULTIVATION, ETC.

Immediately after planting, followed a very rainy spell, lasting until the middle of April. From this time until the middle of May scarcely a drop of rain fell. Owing to excessive moisture, germination was hindered and decay prevented a good stand. Particularly was this the case in a slight depression crossing the rows at right angle, the result of bad plowing, manifested too late for correction. This excessive moisture, followed by a protracted drouth, materially effected the yield. The cultivation was such as is usually given to potatoes.

Though maturing at different times, none were dug until all were ripe.

The crop was harvested June 9th, and assorted; every potato smaller than a pullet's egg was separated as culls, and the crop accurately weighed. Below is a tabulated statement giving the yield per acre, of both large and small, with time of ripening:

YIELD, PER ACRE, OF VARIETIES OF POTATOES HARVESTED. JUNE 9TH, 1888.

NAME OF VARIETY.	Merchantable. No. bushels.	Culls. No. bushels	When ripe.
Early Rose	12.80	12.80	May 22d.
Western Peerless	46.40	12.80	" 26th.
Early Sunrise	36.80	14.40	" 26th.
Beauty of Hebron	65.60	22.40	" 26th.
Louisiana Fall Burbank	81.60	14.40	June 1st.
Burbank	76.80	12.80	" 9th.
Thorburn	46.40	16.00	May 26th.
Russett	43.20	11.20	" 31st.
Peerless	78.40	6.40	June 1st.
Late Beauty of Hebron	28.80	12.80	" 1st.
Great Eastern	89.6	6.40	" 1st.
Dakota Red	64.00	6.40	" 1st.
White Elephant	84.00	9.60	" 1st.
Morning Star	100.80	4.80	" 1st.
*Scotch	126.85	32.25	" 12th.

*Variety not known, but from a barrel of potatoes imported from Scotland.

REMARKS ON VARIETIES.

Early Rose—A variety too well known to need description. Quite a failure with us this year, but generally successful; very badly scabbed.

Western Peerless—Called "Western" because obtained from a Western produce commission merchant in Baton Rouge. It is doubtful whether it is a true Peerless; very slightly scabbed.

Early Sunrise—A long pinkish-colored potato; skin smooth, few eyes, and these not very deep; a very dry, mealy potato; suffered badly from scab.

Beauty of Hebron—Egg-shaped; skin white and smooth; eyes few, but well marked; suffered very little from scab.

Louisiana Fall Burbank—Burbank grown from seed raised in Louisiana last fall; closely resembling its parent in every way, except that it has assumed a reddish hue, and is almost free from scab.

Burbank—A white potato; very well known, and a good bearer, but badly scabbed.

Thorburn—Has a yellowish, slightly russeted, skin; round or cylindrical; eyes of medium depth; somewhat scabbed.

Russet—Approaching a pear-shape; white russeted skin; eyes scarce, and slightly marked; quite scabby.

Late Beauty of Hebron—Irregularly round, having a slightly reddish tinge; eyes few but well marked; slightly scabby.

Great Eastern—Very irregular in shape; of a reddish color; eyes numerous and deeply set; badly scabbed; very dry and mealy.

Dakota Red—A long red potato, with smooth skin; eyes deeply set, but scarce; very scabby.

White Elephant—Large, long white potato with smooth skin; eyes large and very well marked; dry and mealy, both when boiled or baked; one of the best; very little scab.

Morning Star—Long and flat, with white, smooth skin; few but well-marked eyes; remarkably free from scab, and equal to White Elephant when cooked.

Scotch—A variety imported from Scotland, the name of which is not known, but bearing a strong resemblance to the Peerless; scabby.

NEW VARIETIES PROMISING WELL.

As mentioned elsewhere, it is not possible to recommend any one variety from the results of one year. If, however, "coming events cast their shadows before," by looking over the above table we would select the Scotch, Morning Star, Great Eastern, White Elephant, and Louisiana Fall Burbank, as the most promising. Of this list, we might recommend (if our experience with them had been longer) the Morning Star and White Elephant, not only because of their comparatively large yield and freedom from scab, but also because of their excellent qualities for cooking, which far surpass any of the others.

WHEATS (*Triticum Vulgare*).

Owing to the delay in starting the station, neither wheat nor oats could be planted until January. The plat selected was on the same hill as the potatoes. The land was prepared by first breaking up the sod with two-horse turn plow, then thoroughly pulverizing by cross-plowing and harrowing. Owing to the severe drouth just when the wheats were heading, the results are far below what they would have been had the season been more favorable. Seven varieties were planted, on plats one thirty-fourth (1-34) of an acre in size. Below is a table giving date of harvesting and yield, in bushels, to the acre. Harvesting was done while the grain was in the dough:

YIELD OF WHEAT PER ACRE.

Varieties.	Number of bushels.	Pounds of straw.	When harvested.
Martin's Amber.........	....	....	
White Russian.........	6.9	1360	June 10th.
Saskotchawan...........	2.6	1020	" 10th.
*Scotch Fife..............	2.2	578	" 15th.
†Daub's Prolific..........	....	....	
†Glencoe.................	....	....	
†Sibley's New Golden.....	....	....	

* Results vitiated by depredations of chickens.

† A perfect failure.

Besides these, six very small plats of Mexican wheats were planted. Below are the yields, per acre, in bushels:

Varieties.	Number of bushels.	Pounds of straw.	When harvested
Ahuchillain	15.25	3368	May 28th.
Celaya....................	10.2	3675	" 28th.
La Huata..................	5.1	1533	" 28th.
Juanin....................	7.65	4596	" 31st.
Graputa..................	10.02	2661	" 31st.
Wolf Lobo...............	7.65	2756	" 31st.

We have also planted and harvested one variety of Barley and one of Buckwheat. Below are the results:

	Number of bushels.	Pounds of straw.	When harvested.	When planted.
Buckwheat	51.2	2584	July 1st.	April 21st.
Hulless Barley	50.8	697	May 12th.	

The attention of those interested is called to these results, particularly to the Buckwheat. This, besides a good yield of grain in a little over two months growth, gives also over two tons of straw, which, when the crop is harvested at the proper time—*i. e.*, as soon as the grain is hard and before the straw has dried—is a splendid hay. Nor does the value of this crop cease here. Although the land on which it grew has since been plowed and sown in peas, a stand of buckwheat as good as the first, caused from seed dropped while harvesting, now occupies the same land, and will be turned under with the peas. It may be possible, by planting early, to raise three crops during the season from one sowing, two of which may be harvested and the third turned under in the Fall for green manuring.

TOMATOES (*Lycopersicum Esculentum*).

The tomato is a member of the family solanaceae, which furnishes us with three of the most useful plants (potato, egg-plant and tomato) in the world, while the other members of the night-shade family are among the most poisonous. For a long while the only use made of the Tomato was in ornamenting gardens, and it is only within the past forty years that it has taken its deserved place among vegetables fit for food of man. It is not yet popular for that purpose in England and Northern Europe, while in Southern Europe (particularly in Italy and Spain), and in the United States, it is considered an indispensable vegetable. This fact is evidenced by the large amount that is every year canned for winter use.

Plat No. 5—the one selected for varieties of this plant—consists essentially of the same soil as that on which the pota-

toes were grown. This plat was thoroughly prepared and laid off in twenty-eight rows, five by forty-five feet. Two rows were devoted to each variety; one fertilized with stable manure at the rate of one peck to the hill, the other was fertilized with a mixture of four parts of cotton-seed meal, two of acid phosphate, and one of kainite. This mixture was drilled in a furrow opened with bull-tongue, on top of the row, at the rate of six hundred pounds to the acre. The fertilizer was then covered and the plants set out directly over the drill. Although it was impossible to keep an accurate record of the yield, the difference in the effects of these two fertilizers was very marked, the commercial fertilizer not only giving a larger yield than stable manure, but also causing the fruit to ripen much earlier. Fourteen varieties were planted, the names of which, with descriptions and comparative merits, are:

Cardinal—A medium-sized, somewhat irregular, tomato; of a deep red color, a smooth skin, and a good bearer.

Livingston's Perfection—Nearly round, somewhat flattened at the ends; skin smooth, and bright red in color; a good bearer.

Livingston's Beauty—Almost perfectly round, with a pinkish red, smooth, skin; a medium bearer, and of good size.

Livingston's Favorite—Round, with a smooth skin; bright red, and larger than the two preceding; an abundant bearer.

Alpha—A flat, slightly oblong, tomato with a slight sink on top; a cherry red, smooth, skin; ripens a little earlier than the other varieties; of good size, but a limited bearer.

Acme—Almost round, with slight indentations on sides; skin of a pinkish red color; a very good bearer, and of excellent quality.

Paragon—Round, with smooth, brick-red, skin; an abundant bearer; the stem end slightly lobed.

New Jersey—Very regular, round and smooth; of a brick-red color; rather smalll, but a good bearer.

Trophy—Round and smooth, but slightly lobed at stem end; a rich red in color, and an abundant bearer.

Mikado—Very large, deeply lobed and kidney shaped; a deep pink in color; deeply indented on top; the most prolific of the lot; very broad, thick leaves.

Golden Queen—A beautiful, light orange colored tomato, shaped very much like an orange; perfectly smooth, and of good size, but a light bearer; very delicate.

Large Yellow—Very irregular, deeply lobed, kidney-shaped; of a deep yellow color, rather small, but an abundant bearer.

Early Advance—An early bearer, but small and not abundant; round, with smooth, red skin.

Strawberry—Medium sized, round, red and smooth; a poor bearer.

Of the above varieties, the Mikado, the three Livingstons and the Acme seem to have qualities which highly recommend them. The New Jersey and Paragon also deserve some attention.

Great care was exercised in selecting the earliest and largest of each variety for seed. In this way the Station has preserved a few seeds of each variety, which will be distributed next Spring to those desiring them, and will pay transportation charges.

This fall another crop from the same seed will be grown, at which time several methods of training the vines will be tried; also, the effects of various fertilizers; the results of which will be given to the public in due time.

PEA (*Pisum Sativum*).

Six varieties of Peas were planted February 9th, but owing to lack of time to properly prepare the ground the results were poor. Following is a description of each, with time of ripening:

Pride of the Market—A bunch pea, about six to twelve inches high, well filled with pods; pods long and well filled with five to six peas; an abundant bearer, but all ripen at once. Picked May 8th.

American Wonder—A bunch pea, from four to six inches high; an abundant bearer of pods, one and a half to two inches long; from three to four peas to the pod. Picked April 12th.

Thorburn's Extra Early—A running pea, of about the same quality as the preceding, but a better bearer. Ripe April 12th.

Alaska—A gross runner, with two to two and a half inch pod, containing from four to five peas; a profuse bearer. Ripe April 12th.

Daniel O'Rourke—A running pea, somewhat resembling, but inferior to, the former. Ripe April 12th.

McLean's Advance—Running, without forming very much vine; a moderate bearer of pods two inches long, containing three to four peas. Ripe April 23rd.

Besides the above crops, the Station also planted one plat each of White Produce, Welcome, Triumph, and Centennial Oats, which were attacked during the drouth by rust, and were completely destroyed.

ENSILAGE.

BULLETIN

No. 17,

OF THE

STATE EXPERIMENT STATION,

BATON ROUGE, LA.

WM. C. STUBBS, A. M. PH. D.,

DIRECTOR.

—Issued by—

THOMPSON J. BIRD,

COMMISSIONER OF AGRICULTURE,

BATON ROUGE, LA.

BATON ROUGE:

ADVOCATE STEAM BOOK AND JOB PRINT.

1888.

LOUISIANA STATE UNIVERSITY AND
AGRICULTURAL AND MECHANICAL COLLEGE,
Baton Rouge, La., October .., 1888.

MAJOR T. J. BIRD, Commissioner of Agriculture, Baton Rouge, La.:

DEAR SIR—I hand you herewith Bulletin No. 17, containing experiments in Ensilage, with results of chemical investigation by Professor B. B. Ross.

Respectfully submitted,

WM. C. STUBBS,
Director.

ENSILAGE,

Or, the preserving of green substances in pits, or *silos*, has become of such frequent occurrence in parts of this country that no well regulated stock farm is without its silos. In the South, where our winters are of such short duration, the necessity for green food is not so imperative as further North. "Will it not, however, pay every owner of stock, even as far South as Louisiana, to build silos and have ensilage, as a part of his stock rations, even during our short winters?" is a question often asked by our most enquiring farmers. To solve this question, this Station undertook the following experiments.

It must be understood, however, that while any green crop, such as grass, clover, pea-vines, sorghum and corn, can be preserved in pits, the latter crop is the one universally used for ensilage. It possesses many superior qualities. It can easily be grown. It produces large tonnage. It is relished by all kinds of stock, and is easily and cheaply handled.

In the Spring of 1887, two acres of land were taken, thrown up into rows five feet apart, furrows opened, corn drilled and covered with a harrow. After it was well up, it was thinned to a stand of one stalk to three or four inches. After that the cultivation was the same as with field corn. One acre of this was ensilaged, and the other cured into fodder.

While the corn was growing, a cheap and useful silo was constructed on the bank of the bayou, in the following manner: A pit 8x10x12 was dug, with perpendicular sides. From the bottom of this pit a ditch was dug to the bayou, to let the water off. A permanent drain was made by nailing two six-inch boards together and inverting them in the ditch and filling with soil. Into the walls of this pit—at the bottom, middle and top—were sunk scantlings 2x3, parallel with bottom of pit and with each

other. Upon these were placed common ceiling, projecting above the pit about one foot. The pit was now ready for ensilage.

On the 5th of July, after the corn had reached its roasting-ear stage, and the grains began to glaze, it was cut down and hauled by wagons to the pit. Here a Ross ensilage cutter received the corn, and after cutting it in desired lengths, (one-half to three-fourths inches), emptied it directly in the pit. An occasional tamping and leveling of the chips was necessary. After the pit was filled, a little dry oat straw was placed over it, and then covered with twelve-inch boards sawn so as to fit, lapping the planks so as to break the joints. When thus covered, it was weighted with barrels filled with sand. A cheap cover over the pit completed our work.

On the 7th of December, during the session of the Louisiana Central Fair Association, it was opened, and save a thin layer on the top and sides of the pit the fodder was well preserved. It was tested by both cows and horses, and from the readiness with which they devoured it, the unanimous verdict of many visitors was that it was good. The pit was then closed and not opened again until February, when its contents were distributed to the farmers, for use, the Station having no cattle of its own.

That ensilage is a valuable forage for a dairy, has been abundantly proven; and though few cows take readily to it at first, all will eat it and and after a while become fond of it.

In filling a silo, it is no longer deemed necessary to rush the green fodder directly to the pit, fill the latter as fast as possible and cover with dispatch. On the contrary, the corn cut in the morning is permitted to lie in the sun all day, and then ensilaged. Even rapid filling of the pit is objectionable, and two or three days' respite while filling is now deemed advisable. In fact, those who practice ensilage on a large scale, now usually have several pits. They partially fill and go on to the next, leaving several days' interval between their work at each pit. In this way, the first stage of fermentation, together with the heat produced, is over before the pit is closed. So, too, after the pit is filled it is left for several days before it is covered.

It is not necessary for its preservation to cut the corn, but it is far more economical. Ensilage cutters are cheap, and the power required to cut the corn is not great.

The most valuable variety of corn for ensilage is yet a mooted question. In the North and West, our Southern field corn is largely sold for ensilage purposes; and it has, doubtless, on account of size of stalk, superiority over Northern corn. But have we not a variety, or varieties, which have, in themselves, a superiority over our common corn, for ensilage?

This year there were grown upon the Station many varieties of corn—among others, two of Mexican corn. The latter were very conspicuous on account of large stalk and immense height. Several stalks were over thirteen feet high and measured one and one-half ($1\frac{1}{2}$) inches in diameter. A trial will be given these varieties next year.

That corn can be kept in pits in a good condition, in Louisiana, is now abundantly demonstrated. Whether it will be economy to establish silos, is a question which the farmers must decide.

Pits can be built in barns, above ground as well as below the ground. The former has the preference always, with those who have had experience with silos, since they are much easier fed from.

The fact that ensilage can be successfully practiced in Louisiana, coupled with the further fact that corn here grows enormously large and tall, makes the potentialities, large as they were before, even now greater of raising all kinds of stock profitably in this State.

Samples of the ensilage and of the cured fodder were given Professor B. B. Ross, who kindly investigated their chemical properties and digestibility. I herewith insert his able report:

LOUISIANA STATE UNIVERSITY AND
AGRICULTURAL AND MECHANICAL COLLEGE,
Baton Rouge, La., October —, 1888.

PROF. W. C. STUBBS, Director Experiment Station, Baton Rouge, La.

DEAR SIR—I herewith hand you report of examination of the samples of corn fodder and ensilage submitted to me for analysis.

Very respectfully,

B. B. ROSS,

Professor of Chemistry.

ANALYSES OF SAMPLES.

The sample of ensilage was carefully drawn from the silo, and weighed immediately in order that the amount of water present could be accurately determined. After being well air-dried, the sample was cut up very finely and the size of the particles further reduced by thorough grinding and pulverizing. At the same time a sample of fodder was obtained, cut at the same stage of growth as the ensilage sample, which was likewise prepared for analysis by a process of thorough pulverization. The ensilage, when first taken from the pit possessed the characteristic odor of acetic acid (vinegar), showing that acetous fermentation had set in, although it doubtless had made comparatively little progress, as in closed silos the gases produced in incipient fermentation check any further tendency to decomposition. After being completely air-dried, however, all traces of this odor disappeared, the dry sample having the very agreeable smell possessed by fresh clover, and quite in contrast to the musty odor of the corn fodder, itself.

The methods followed in the determination of the proximate constituents of the feeding stuffs, were essentially those adopted by the official Association of Agricultural Chemists, at their last annual meeting. Below is given the percentage composition of the ensilage and dry fodder, not only for the air-dried and completely dried substances, but in the case of the former the analysis of the fresh substance is also given:

ANALYSIS OF FRESH ENSILAGE.

	Per cent.
Water	74.94
Ash	2.61
Crude Protein	2.04
Fats	0.64
Carbohydrates	12.26
Crude Fibre	7.51
Total	100.00
Digestible Protein	1.48

ANALYSIS OF THE AIR DRIED SUBSTANCE.

	Ensilage. Per cent.	Fodder. Per cent.
Water	11.72	10.50
Ash	9.20	5.87
Crude Protein	7.19	8.59
Fats	2.24	1.52
Carbohydrates	43.20	48.77
Crude Fibre	26.45	24.75
Total	100.00	100.00
Digestible Protein	5.22	5.61

ANALYSIS OF THE COMPLETELY DRIED SUBSTANCE.

	Ensilage. Per cent.	Fodder. Per cent.
Ash	10.42	6.56
Crude Protein	8.14	9.60
Fats	2.54	1.69
Carbohydrates	48.94	54.50
Crude Fibre	29.96	27.65
Total	100.00	100.00
Digestible Protein	5.91	6.33
Per cent. of total Protein digestible	72.60	65.94
True Protein	6.19	7.82
Per cent. of True Protein to Crude Protein	76.04	81.46

EXPLANATION OF ANALYSES.

In the analysis of feed stuffs the proximate and not the ultimate (or elementary) constituents are generally determined. It has been found that in order to arrive at the relative merits of fodders, etc., for feeding purposes, it is only necessary in most cases to ascertain the percentages of ash, albuminoids (or protein), fats, carbohydrates, and woody fibre, or cellulose. It is also of the utmost importance that the proportion of water present in the sample be correctly determined, as the percentage of this substance in feed stuffs is so variable that no proper comparison of their relative nutritive values can be instituted until the pro-

portion of the constituents present in the dry substance can be ascertained.

The amount of dry matter can be determined by heating the substance at a temperature of 212 degrees, Fahrenheit, until the sample shows no further loss of weight; the difference in weight representing the amount of water present. Upon exposure to the atmosphere the dry sample will re-absorb a considerable proportion of moisture, usually regaining the amount previously contained in the air dried feed stuff.

The ash contains the mineral constituents of the feeding stuffs, and its proportion is ascertained by burning out the combustible portions, with free access of air. These mineral substances consist chiefly of potash, soda, lime and magnesia in combination with hydrochloric, carbonic, phosphoric and sulphuric acids, and also silica, together with a little unconsumed charcoal.

As these mineral substances generally occur in sufficiently abundant quantities in most forage plants, the amount of ash is considered of little importance in estimating the feeding value of fodder. Crude protein (or albuminoids) constitutes the chief bulk of the nitrogenous substances present in feeding stuffs. The term is quite comprehensive in its scope, and includes such substances as the casein of milk, fibrin of flesh, and albumen of blood and the egg, which are considered as modifications of a primary substance (protein), these different forms bearing a general resemblance to each other in composition and properties, and convertible into each other by processes carried on in the animal body. These albuminoids substances contain carbon, hydrogen, nitrogen, and oxygen, and frequently a small proportion of sulphur. Indeed, the exact chemical composition of the different modifications of albuminoids has not yet been definitely determined, but it is known that nitrogen is one of the least variable (in quantity) of their constituents, and that the average proportion of that valuable element is about sixteen per cent. So that, in the analysis of feed stuffs, the rule generally adopted in ascertaining the percentage of albuminoids is to first determine the percentage of nitrogen present and then multiply this per-

centage by 6.25 (16x6.25–100). This does not give us the exact but only the approximate amount of albuminoids present, as all albuminoids do not contain sixteen per cent., nor is all the nitrogen in the feed stuffs combined in the form of albuminoids. However, in the statement of the percentages of the proximate constituents determined, the proportion of crude albuminoids given is in each obtained by multiplying the nitrogen present by 6.25. This has been done because it approximates very closely the true percentage, and because all of the standards of comparison to which we can refer in determining the relative nutritive values of fodders, give albuminoids as determined in the same manner. The true albuminoids in both the ensilage and the fodder have been determined, however, and in the statement of analysis the percentage is given together with the proportion of true albuminoids to crude albuminoids.

The albuminoids are regarded as the chief constituent of value, as, without undergoing any very considerable alteration, they are utilized in the animal body, in the formation of animal albuminoids, such as the fibrin of muscles and tendons, and the albumen and casein of blood and milk; and not only contribute to the growth of the animal, but tend to repair and replace the worn out muscles, membranes, tissues, etc.

The term fats includes all matters extracted from the dry fodder by ether, and the proportion of fats is generally less than that of any other proximate constituent. Vegetable fats are utilized in the animal economy, either in making fat or in furnishing heat to the body by the oxidation of their carbon and hydrogen; this process of oxidation being perfectly analagous to the ordinary processes of combustion.

The class of substances called carbohydrates are, in conjunction with the fats, also of great utility in producing and maintaining animal heat, but practical experiments, within recent years, have led scientists to believe that fats have two and one-half (2½) times the value of carbohydrates in the production of heat by their oxidation. Carbohydrates, as the name implies, consist of carbon together with hydrogen and oxgen, in the relative proportions in which they exist in water. Under

this term are included starch, sugar, gums and other bodies closely allied in chemical composition and properties.

The cellulose, or fibre, constitutes the most insoluble and, generally, the most indigestible portion of feeding stuffs. Although pure cellulose (as lint côtton) is identical in composition with starch, in its physical properties and chemical deportment there is the widest difference. It was formerly considered almost, if not wholly, indigestible; but experiments have shown that quite a large percentage is digested by animals, and may be turned to account either as an auxiliary or as a substitute for fats or carbohydrates, in furnishing oxidizable and heat-producing constituents to the blood.

In order that each of the prlncipal constituents of feeding stuffs may be utilized to the greatest possible advantage, in the performance of their several functions in the animal economy, it has been found essential that they exist in certain relative proportions, just as in the application of commercial fertilizers to soils the relative percentages of their three essential constituents must be taken into consideration.

It has been ascertained by carefully conducted experiments in cattle feeding that in estimating the comparative feeding values of fodders, there should be determined what is known as the nutritive ratio—or, the ratio of digestible carbohydrates to digestible albuminoids—just as in the operation of a steam engine there is a ratio between the cost of fuel and the cost of the materials of repair. In determining this nutritive ratio, fats must also be taken into consideration, and as they are assumed to have a value of two and one-half ($2\frac{1}{2}$) times their weight of carbohydrates, the amount of digestible fat, after being multiplied by two and one-half ($2\frac{1}{2}$), is added to the digestible carbohydrates.

In calculating the nutritive ratios of the fodder and ensilage analyzed, the percentages of digestibility of the carbohydrates and fats were taken from the rssults of practical digestion experiments on corn fodder in Europe, while the percentage digestibility of albuminoids was determined by means of artificial digestion with pepsin solution. It was found that there was

almost a perfect coincidence in the nutritive ratios of the two feeding stuffs: the ratio for ensilage being 1:6.26, while that for the fodder was 1:6.43.

DIGESTION EXPERIMENTS.

The digestibility of the albuminoids in the feeding stuffs was determined by treatment with pepsin solution corresponding closely in composition and solvent or digestive power to the gastric juice, the most important of all the animal digestive fluids. The principal constituents of this juice are lactic and hydrochloric acids, and a substance called pepsin secreted in the lining of the stomach and possessed of wonderful digestive or peptonizing properties, especially as regards albuminoids.

Pepsin is at present largely prepared from the stomach of the pig (*pepsina porci*), and is frequently administered medicinally to aid or promote digestion.

The pepsin solution used contained ten (10) grams of pepsin in two (2) litres of water, acidulated with ten (10) grams of hydrochloric acid—(Sp. gr. 1.1975)—and the finely ground material was kept at a constant temperature of 104 degrees, Fahrenheit, for two periods of twelve hours each, one-tenth (0.1) per cent. of hydrochloric aeid being added at intervals of three hours, so that at the end of the twenty-four hours (24) one (1) per cent. of the acid would be present.

As the principal function of the gastric juice is to digest albuminoids, only the result of the digestion of albuminoids is given in the statement of analysis. It was found, however, by analysis that the cellulose was completely indigestible in the pepsin solution, and only a comparatively small proportion of the fats and carbohydrates were digested. It will be seen on reference to the table of analyses that 65.94 per cent. of the albuminoids in the fodder were digestible, and 72.6 per cent. of albuminoids in the ensilage, while the results of a large number of practical trials in feeding animals show that an average of 73 per cent. of albuminoids in corn fodder is digestible.

ANALYSES

— OF —

COMMERCIAL FERTILIZERS.

BULLETIN No. 18

— OF THE —

STATE EXPERIMENT STATION

WM. C. STUBBS, Ph. D., Director.

— Issued by —
THOMPSON J. BIRD,
COMMISSIONER OF AGRICULTURE,
BATON ROUGE, LA.

BATON ROUGE:
PRINTED BY THE ADVOCATE PUBLISHING COMPANY
1888.

OFFICE BUREAU OF AGRICULTURE,
Baton Rouge, La., October —, 1888.

To His Excellency Francis T. Nicholls, Governor of Louisiana and President of the State Bureau of Agriculture:

SIR:—

In compliance with the provisions of Act 51, of 1886, herein please find the analyses made by Dr. W. C. Stubbs, Director and Official Chemist; also, the list of Commercial Fertilizers sold in the State during the season of 1887–88, the brands of the fertilizers, their guaranteed analyses, names of the dealers to whom licenses have been issued, etc. The demand for fertilizers during the last season has decidedly increased. The general character of the article offered for sale has been fairly within the guarantee given. The costs of the different brands have varied but little from that of the previous season, and indications are that no material changes can be expected this season.

T. J. BIRD,
Commissioner Bureau of Agriculture.

Louisiana State University and A. & M. College,
Baton Rouge, La., October —, 1888.

Major T. J. Bird, Commissioner of Agriculture, Baton Rouge, La.:

Dear Sir—I hand you herewith the Analyses of Commercial Fertilizers made since our last report, together with the Fertilizer Law, with the request that you publish the same as Bulletin No. 18:

Respectfully submitted,

WM. C. STUBBS,

Director.

REPORT OF THE DIRECTOR.

The analyses contained in this report are of four kinds:

1. Of samples selected at the discretion of the Commissioner of Agriculture.

2. Of samples drawn by the purchaser, under regulations prescribed by the Commissioner of Agriculture.

The above are required by law.

3. Of samples used by the Stations.

4. Of samples sent by private parties.

While the Station is not required by law to work for private parties, yet all samples sent by individual citizens of the State will be analyzed without charge; *provided*, the means of the Station will permit; and *provided*, always, that in the discretion of the Director such analyses will be conducive to public welfare.

The Fertilizer Law is herein inserted for the guidance of the public. Under it, every citizen of the State is amply protected from fraud and imposition by unscrupulous dealers, and there exists absolutely no cause for distrust in the purchase of commercial fertilizers, if the farmer will but claim the protection afforded him. The sellers of good wares are also protected, as ample facilities are afforded them of properly advertising their goods.

Only cotton-seed meal, land plaster, salt, ashes, lime, and bones not specially treated, are exempt from the provisions of this law.

Bones ground to a powder by machinery, as well as *bones treated with acid*, are included in the law, since they *have been specially treated.*

The following is the law:

SEC. 2. Be it further enacted, etc., That it shall be the

duty of any manufacturer or dealer in commercial fertilizers, before the same are offered for sale in this State, to submit to Commissioner of Agriculture a written or printed statement setting forth: First—the name and brand under which said fertilizer is to be sold, the number of pounds contained or to be contained in the package in which it is to be put upon the market for sale, and the name or names of the manufacturers, and the place of manufacture; Second—A statement setting forth the amount of the named ingredients which they are willing to guarantee said fertilizers to contain: (1) nitrogen, (2) soluble phosphoric acid, (3) reverted phosphoric acid, (4) insoluble phosphoric acid, (5) potash. Said statement, so to be furnished, shall be considered as constituting a guarantee to the purchaser that every package of such fertilizer contains not less than the amount of each ingredient set forth in the statement. This shall, however, not preclude the party making the statement from setting forth any other ingredient which his fertilizer may contain, which additional ingredient shall be considered as embraced in the guarantee above stated.

Sec. 3. Be it further enacted, etc., That every person proposing to deal in commercial fertilizers shall, after filing the statement above provided for, with the Commissioner of Agriculture, receive from the said Commissioner of Agriculture a certificate stating that he has complied with the foregoing section, which certificate shall be furnished by the Commissioner without any charge therefor. That the said certificate, when furnished, shall authorize the party receiving the same to manufacture for sale, in this State, or to deal in this State in commercial fertilizers. That no person who has failed to file the statement aforesaid and to receive the certificate of authority aforesaid, shall be authorized to manufacture for sale in this State commercial fertilizers. And any person so manufacturing for sale, in this State, or so dealing, without having filed the aforesaid statement, and received the certificate aforesaid, shall be liable for each violation to a fine not exceeding one thousand dollars, which fine shall be recoverable before any court of competent jurisdiction, at the suit of the Commissioner of Agri-

culture, or of any citizen, and shall be disposed of as hereafter provided.

Sec. 4. Be it further enacted, etc., That it shall be the duty of the Bureau of Agriculture, or its Commissioners, at the opening of each season, to issue and distribute circulars, setting forth the brands of fertilizers sold in this State, their analyses as claimed by their manufacturers or dealers, and their relative and (if known) their commercial value.

Sec. 5. Be it further enacted, etc., That it shall be the duty of the Commissioner of Agriculture, under the regulations of the said Bureau, to cause to be prepared tags of suitable material, with proper fastenings for attaching the same to packages of fertilizers, and to have printed thereon the word "guaranteed," with the year or season in which they are to be used, and a fac-simile of the signature of said Commissioner. The said tags shall be furnished by said Commissioner to any dealer in or manufacturer of commercial fertilizers, who shall have complied with the foregoing provisions of this act, upon the payment by said dealer or manufacturer, to the said Commissioner, of fifty cents for a sufficient number of said tags to tag a ton of such commercial fertilizer.

Sec. 6. Be it further enacted, etc., That it shall be the duty of every person, before offering for sale any commercial fertilizers in this State, to attach or cause to be attached, to each bag, barrel or package thereof, one of the tags herein before described, designating the quantity of the fertilizer in the bag, barrel or package to which it is attached. Any person who shall sell or offer for sale, any package of commercial fertilizer which has not been tagged as herein provided, shall be deemed guilty of a misdemeanor, and, on conviction thereof, shall be fined in the sum of two hundred and fifty dollars for each offense, and the said person shall be, besides, liable to a penalty of one hundred and fifty dollars for each omission, which penalty may be sued for either by the Commissioner of Agriculture or by any other person for the uses hereinafter declared. Any person who shall counterfeit or use a counterfeit of the tag prescribed by this act, knowing the same to be counterfeited, or

who shall use them a second time, shall be guilty of a misdemeanor, and on conviction thereof shall be fined in a sum not to exceed five hundred dollars, one-half of which fine shall be paid to the informer, which fine shall be doubled or trebled at each second or third conviction, and so on progressively, for subsequent convictions.

Sec. 7. Be it further enacted, etc., That all fertilizers or chemicals for manufacturing or composting the same, offered for sale or distribution in this State, shall have printed upon, or attached to each bag, barrel or package, in such manner as the Commissioner of Agriculture may by regulation establish, the true analysis of such fertilizer or chemical as claimed by the manufacturer, showing the per cent. of valuable ingredients such fertilizers or chemicals contain.

Sec. 8. Be it further enacted, etc., That the Commissioner of Agriculture may obtain, or cause to be obtained, at his discretion, fair samples of all fertilizers sold, or offered for sale, in this State, from manufacturers or dealers, and shall have them analyzed by the official chemist, and shall publish the analysis for the information of the public.

Sec. 9. Be it further enacted, etc., That it shall be the duty of every person who sells a lot or package of commercial fertilizer, upon the request of the purchaser, to draw from same, and in the presence of the purchaser or his agent, a fair and correct sample, in such manner as the Commissioner of Agriculture may, by regulation, establish.

Sec. 10. Be it further enacted, etc., That the copy of the official chemist's analysis of any fertilizer or chemical, certified to by him, shall be admissible as evidence in any court of this State, on the trial of anything involving the merits of said fertilizer.

Sec. 11. Be it further enacted, etc., That the Bureau of Agriculture shall adopt needful rules and regulations providing for the collection of the money arising from the sale of tags, or from fines imposed under this act, and shall require the same to be deposited with the Treasurer of the State, and only to be drawn therefrom upon the warrants issued by the Auditor of the State

upon the requisition of the Commissioner of Agriculture, made in pursuance of such rules and regulations; and the said Commissioner of Agriculture shall be entitled to receive no fees for collecting or disbursing said money, except his salary as provided for by law; but he shall be allowed a clerk at the salary to be fixed by the said Bureau, and to be payable out of the fertilizer funds; and all sums of money arising from the provisions of this act shall be known as the "Fertilizer Fund," and shall be kept by the Treasurer separate from other public funds, and shall be exclusively used, as far as they may go, to defray the expenses of developing agriculture by making practical and scientific experiments in relation thereto.

Sec. 12. Be it further enacted, etc., That for the purpose of making practical and scientific tests or experiments, it shall be the duty of said Commissioner, subject to the approval of said Bureau, to enter into contracts specifying the duration and conditions thereof, with a competent chemist and expert in experimental agriculture, to perform the duties of official chemist and to carry on and to conduct the experiment station established by said Bureau at Baton Rouge; and with the Louisiana Scientific Agricultural Association, having an experiment station in the Parish of Jefferson; and, in making such contracts, the said Commissioner shall provide that experiments be made for the development and benefit of agriculture, especially in relation to the standard crops of the State, such as cotton, sugar, rice, corn, the cereals and grasses, and the like.

Sec. 13. Be it further enacted, etc., That as compensation for the conduct of such experiments, the Commissioner of Agriculture be and he is hereby authorized to apply the net result from the sale of tags, and from fines or penalties imposed for violations of the terms of this act, to the two stations, and, if necessary, parts of other sums that may be appropriated by law, and subject to the control of himself or said Bureau; provided, That said contract shall not give more than one-half of the result of the sale of tags, and fines, to any one of said stations; and provided further, That the said stations undertake to perform for and on behalf of the Commissioner of Agriculture, under

such regulations as may be agreed on, all analyses required under this act free of any charge whatsoever.

Sec. 14. Be it further enacted, etc., That the Director of the State Experiment Station shall be considered as the official chemist of the Bureau of Agriculture. He shall also attend such chemical and agricultural conventions as may be necessary; the traveling expenses incident to such attendance shall be chargeable and collectable from the revenues derived from the sale of tags.

Sec. 15. Be it further enacted, etc., That the Commissioner of Agriculture shall keep a correct and faithful account of all tags received and sold by him, showing the number sold, to whom sold, and, as far as practicable, for what fertilizers they were intended to be used, and the amount of money collected therefor, and all money arising from fines, under this act.

Sec. 16. Be it further enacted, etc., That the term "commercial fertilizers," or "fertilizers," where the same are used in this act shall not be held to include lime or land plaster, cotton seed meal, ashes or common salt, or raw bone, not specially treated.

The following, taken from a previous Bulletin, is herein inserted as explanatory of the terms to be subsequently used:

COMMERCIAL FERTILIZERS.

The ingredients which give value to all commercial fertilizers are, 1st, Nitrogen (Ammonia); 2d, Phosphoric Acid; 3d, Potash. A fertilizer may contain one, two, or all of these ingredients. When all are present, the compound is usually styled a "*complete* manure"; when only one or two are present, it is a "*partial* manure."

Partial manures may consist of: (1), Nitrogen (Ammonia) alone; (2), Phosphoric Acid alone; (3), Potash alone; (4), Nitrogen (Ammonia) and Phosphoric Acid; (5,) Phosphoric Acid and Potash: (6), Nitrogen (Ammonia) and Potash. No. 6 is rarely found in Southern markets; the others are common wares.

(1.) NITROGEN MANURES.

Nitrogen is the most costly ingredient in manures. It is offered to the trade in three forms:

a.—Mineral Nitrogen—in Nitrate of Soda and Sulphate of Ammonia.

b.—Animal Nitrogen—in Dried Blood, Tankage, Azotin, Ammonite, Fish Scrap and Leather.

c.—Vegetable Nitrogen—in Cotton Seed, Cotton-seed Meal, Linseed Meal, Castor Pomace and Peat.

Blood, Tankage, Fish Scraps and Oil Meals are highly active fertilizers, while Leather and Peat are slowly available. The result of decomposition of organic forms of Nitrogen is either Ammonia or Nitric Acid; fourteen parts of Nitrogen yielding seventeen parts of Ammonia, or twenty-eight parts of Nitrogen forming, by nitrification, one hundred and eight parts Nitric Acid. The mineral forms of Nitrogen are highly prized in the North and England; but in the South, on account of the ease with which they are washed from the soil, they should be used with great care.

Cotton-seed Meal contains, besides Nitrogen, small amounts of Phosphoric Acid and Potash. A fair sample of meal, *free from hulls*, should yield 7 per cent. Nitrogen, 3 per cent. Phosphoric Acid, and 2 per cent. Potash. This is a cheap source of Nitrogen, and experiments have demonstrated that it is, perhaps, the best form for Southern Agriculture. In buying it, however, *caution* is necessary to see that it is well decorticated, *i. e.*, free from hulls. Samples containing 30 per cent. of hulls have been found on the market.

(2.) PHOSPHORIC ACID MANURES.

These are generally phosphatic rocks treated with Sulphuric Acid. Sometimes pure bones or bone black, or bone ash, are treated with the same acid, and the resulting mixtures styled Dissolved Bones or Superphosphates. When made from phosphatic rock, bone black or bone ash, they contain only Phosphoric Acid. When pure bones are used, 3 to 5 per cent. of

Ammonia is also found. These phosphatic manures usually contain their Phosphoric Acid in different forms. Some of it is readily soluble in water, and is highly available as plant food; some of it is only soluble in acids, and is, therefore, only slowly, if at all, available to plants, while another portion is intermediate in solubility between the water soluble and the acid soluble. The chemist uses Citrate of Ammonia to dissolve this form; and hence it is denominated as Citrate Soluble Phosphoric Acid. It is believed by many that this form of Phosphoric Acid has resulted from a chemical action of the water soluble upon the acid soluble, and hence it is often called "*reverted*," "*reduced*," etc. The water soluble is readily available on all soils and by all plants; the citrate soluble in soils containing vegetable matter is believed to be available to many plants, while the acid soluble is immediately useful only to certain plants and upon certain soils. The water soluble and citrate soluble are usually taken together and called Available Phosphoric Acid. In buying phosphatic manures, preference should be given, first to the water soluble, then to the citrate soluble. If there is much Acid Soluble Phosphoric Acid present, inquiry should be at once made as to its origin, for the Insoluble Phosphoric Acid from bones is more easily transferred into plant food than that from rock. These three forms of Phosphoric Acid are usually called "soluble," "reduced" and "insoluble."

(3.) POTASH MANURES.

These are now obtained almost exclusively from Leopoldshall and Stassfurth, Germany, and are largely sold in this country as *(a)* Kainite, which is a crude product of the mines, and consists of Potash, Magnesia, Soda, Sulphuric Acid and Chlorine. This form of Potash is now extensively used in the South, either in the compost of stable manure, cotton seed and Acid Phosphate, or mixed with Acid Phosphate and cotton seed meal to form a complete manure. Whether our soils need Potash can only be determined experimentally. After careful experimentation the right quantities can be easily determined. It is a cheap and an excellent source of Potash.

(b) Sulphate of Potash, a refined product containing a large amount of Potash in a very desirable form, is extensively used in some countries upon certain crops, notably tobacco and Irish potatoes.

(c) Muriate of Potash, another refined product containing a large percentage of Potash. This salt furnishes potash in the cheapest form.

(4.) NITROGEN AND PHOSPHORIC ACID.

Formerly bones, treated with Sulphuric Acid, were frequently found upon our market; recently, however, Potash, in some form, has always been added to them. Whether this addition has been made by the demands of the soil or by the inclination of the manufacturers, is yet to be determined. Potash is the cheapest ingredient in fertilizers, and any demand for it is readily met. At present we find on our markets a manure of this class which is being extensively used under sugar cane, viz: *Tankage.* This is a variable goods, containing, usually, from 5 to 12 per cent. of Nitrogen, and from 6 to 20 per cent. Phosphoric Acid. This latter is in the insoluble form; but, being of animal origin, upon certain soils is slowly available.

(5.) PHOSPHORIC ACID AND POTASH.

To make Acid Phosphates suitable for composting, many dealers have recently added Potash. This addition necessarily lowers the percentage of Phosphoric Acid. Manufacturers in and around Charleston, S. C., have adopted the custom of calling this class of goods "Acid Phosphates," and those which contain no Potash, "Dissolved Bones." These are extensively used for the compost of stable manure and cotton seed.

(6.) NITROGEN AND POTASH.

The great and crying want of Southern soils is Phosphoric Acid; hence no manure without it has hitherto met with favor. Accordingly this class of manures is wanting in the South.

COMPLETE MANURES,

Are those which contain Nitrogen, Phosphoric Acid and Potash. For different crops these ingredients should exist in different proportions. Before purchasing any fertilizer, the farmer should study well the wants of his soil and his crop, and buy accordingly.

Before buying, get from the dealer replies to the following questions.

How much Water Soluble Phosphoric Acid do you guarantee?

How much Citrate Soluble Phosphoric Acid do you guarantee?

How much Ammonia do you guarantee?

How much Potash do you guarantee?

In a plain Acid Phosphate at least 12 per cent. available Phosphoric Acid should be guaranteed. In cane fertilizers, 3 per cent Ammonia and 7 per cent. Phosphoric Acid, and in cotton fertilizers 2 per cent. Ammonia and 8 per cent. of Phosphoric Acid should be found.

EXPLANATION OF ANALYSES.

Nitrogen, Phosphoric Acid and Potash are the three ingredients which give value to commercial fertilizers, and are the only ones determined in offiicial analyses.

Nitrogen is the most costly as well as the most valuable fertilizing ingredient. It occurs as Organic Nitrogen in animal and vegetable matters—easily decomposed and quickly available in blood and meat, slowly disintegrated, and of doubtful value in leather or peat unless specially treated.

All Organic Nitrogen is first converted into Nitric Acid or Ammonia, in the soil or compost heap, before it can be used by plants. Nitric Acid and Ammonia are furnished in commerce, the one in the forms of Nitrates of Soda and Potash, the other as Sulphate of Ammonia.

Soluble Phosphoric Acid refers only to such phosphates as are soluble in pure water and is made by treating bones, bone

ash, bone black, or mineral phosphate with sulphuric acid. It is the chief ingredient of Acid Phosphates, Superphosphates or Dissolved Bones.

By Reverted Phosphoric Acid, reference is made to that form of Acid which, though insoluble in water, is freely soluble in certain salts, particularly Citrate of Ammonia.

Insoluble Phosphoric Acid refers to that form that is soluble only in Acids.

Potash is the ingredient usually found in ashes, and should be soluble in water.

VALUATION OF FERTILIZERS.

The commercial value of a Fertilizer is regulated by the prices demanded in commerce for the different forms of the three ingredients, Nitrogen (Ammonia), Phosphoric Acid and Potash. These prices fluctuate according to the demand and supply. In the North, Nitrogen is assigned a separate valuation for each of the forms—that in Nitrates and Ammonia Salts receiving the highest figure, and that in leather and peat the lowest.

In Connecticut or Massachusetts, a determination of the forms in which this ingredient occurs must be made before its commercial value can be calculated. All the forms of Nitrogen have heretofore been considered of equal money value in the South, and but one price assigned. This, of course, precludes the existence of Nitrogen in form of leather dust, or powdered horn, forms regarded as unavailable and of little money or agricultural value.

The soluble and reverted forms of Phosphoric Acid have together been styled as "available," and assigned one value. The insoluble Phosphoric Acid has received no valuation. All forms of Potash soluble in water have been regarded as of equal value.

At a convention of Southern State Chemists, held at Athens, Ga., in 1886, the following tariff of prices was adopted:

Ammonia, 16 cents per pound.

Nitrogen, 19½ cents per pound.

Soluble Phosphoric Acid $7\frac{1}{2}$ cents per pound.
Reverted Phosphoric Acid, $7\frac{1}{2}$ cents per pound.
Potash (soluble in water), 5 cents per pound.

The writer, though not present at the convention, deems it best, for the sake of harmony in State valuations, to adopt this tariff for the present year, though he wishes to dissent from the opinion that Reverted Phosphoric Acid is of equal value as the soluble form, or that Nitrogen is of the same money value in all its forms.

The above are commercial values, that is what these ingredients, properly mixed and sacked, can be purchased for in the markets of the South. The above tariff, when applied to fertilizers bought in New Orleans, will be found to give values beyond the actual selling prices. For example, good cotton-seed meal contains 7 per cent. Nitrogen, 3 per cent. Phosphoric Acid and 2 per cent. Potash; neglecting the Phosphoric Acid and Potash, and estimating its value only on its content, there will be obtained for one ton 140 pounds of Nitrogen at $19\frac{1}{2}$ cents.—$27.30. It is well known that this fertilizer could be bought at any time in the year, in New Orleans, at about $20 per ton.

This form of Nitrogen comes entirely from the South, while all others are products of Northern or foreign climes. Home consumption takes only a small portion of the output of our mills, the greater part finding its way to the North and to Europe.

This export demand regulates the price, and hence we have the cheapest form of Nitrogen presented to us in our own home product, viz.: Cotton Seed Meal.

By applying the above to a fertilizer of known composition, and comparing the result with the actual selling price, the consumer can easily tell whether he is getting value received.

HOW TO COMPUTE THE VALUE OF A FERTILIZER.

A fertilizer is purchased whose guaranteed analysis recorded on the sack as follows:

Nitrogen, 3 per cent.
Soluble Phosphoric Acid, 6 per cent.

Reverted Phosphoric Acid, 4 per cent.
Potash, 2 per cent.

What is its commercial value?

IN ONE TON WE HAVE:

3 per cent.	Nitrogen	60 lbs.	at 19½ cents	$11.70
6 per cent.	Solub'e Phosphoric Acid	120 lbs.	at 7½ cents	9.90
4 per cent.	Reverted Phosphoric Acid	80 lbs.	at 7½ cents	6.00
2 per cent.	Potash	40 lbs.	at 2 cents	2.00
	Commercial value, per ton			$28.70

By comparing the above with the amount paid, the consumer can easily calculate whether he has paid too much.

The work done in the Laboratory, since our last report, may be classified as follows:

18 Ammoniated Superphosphates and Guanos.
6 Acid Phosphates.
5 Cotton-seed Meal.
7 Tankage.
5 Phosphates.
3 Bat Manures.
1 Fish Scrap.
1 Bone Meal.
1 Dried Blood.
1 Sulphate of Ammonia.
1 Nitrate of Soda.
1 Lignite.
1 Oyster Shell Lime.

The relative commercial values are proven only to the Ammoniated Superphosphates and Acid Phosphates, since under existing tariff no value is assigned insoluble Phosphoric Acid.

The Ammoniated Superphosphates and Guanos include the various fertilizers sold in this State for cotton, cane, rice, etc. They contain all three of the chief fertilizing ingredients, and may be classified as Complete Manures. Made for different crops, these ingredients are by no means constant, but vary

according to the manufacturer's ideas of the demand of each particular crop for each particular ingredient.

AMMONIATED SUPERPHOSPHATES AND GUANOS.

Station No. 117.—Guano; sent by Millard Bosworth, Cypremort P. O., La.

Station No. 118.—Guano; sent by Millard Bosworth, Cypremort P. O., La.

Station No. 120.—Oat Fertilizer; sent by Lucien Soniat, Tchoupitoulas Plantation, La.

Station No. 121.—Sugar Cane Fertilizer; sent by Lucien Soniat, Tchoupitoulas Plantation, La.

Station No. 147.—Peach Tree Fertilizer; sent by Planters' Fertilizer Company, New Orleans, La.

Station No. 152.—Guano; sent by McCall Brothers., Donaldsonville, La.

Station No. 153.—Guano; sent by Planters' Fertilizer Company, New Orleans, La.

Station No. 159.—Guano; sent by Planters' Fertilizer Company, New Orleans, La.

Station No. 161.—Guano; sent by Planters' Fertilizer Company, New Orleans, La.

Station No. 163.—Guano; sent by Cartwright Eustis, New Orleans, La.

Station No. 164.—Cotton Goods; sent by Planters' Fertilizer Company, New Orleans, La.

Station No. 166.—Guano; sent by McCall Brothers, Donaldsonville, La.

Station No. 167.—Guano; sent by McCall Brothers, Donaldsonville, La.

Station No. 168.—Guano; sent by McCall Brothers, Donaldsonville, La.

Station No. 170.—Guano; sent by T. D. Miller & Co., New Orleans, La.

Station No. 171.—Guano; sent by T. D. Miller & Co., New Orleans, La.

Station No. 172.—Guano; sent by Hon. Edward J. Gay, New Orleans, La.

Station No. 173.—Guano; sent by Trosclair & Robichaux, Thibodeaux, La.

ANALYSES OF AMMONIATED SUPERPHOSPHATES AND GUANOS.

Station.	Soluble Phosphoric Acid.	Reduced Phosphoric Acid.	Insoluble Phosphoric Acid.	Total Phosphoric Acid.	Nitrogen.	Ammonia.	Potash.	Relative Commercial Value.
No. 117	7.87	0.27	0.12	8.26	3.15	3.82	2.69	$25.77
" 118	7.21	0.31	0.38	7.90	3.43	4.17	2.89	26.06
" 120	4.61	2.04	0.26	6.91	3.71	4.51	.....	24.40
" 121	5.76	2.05	0.25	8.06	3.08	3.74	.....	23.68
" 147	5.10	0.42	0.24	5.76	2.11	2.55	7.71	20.29
" 152	8.17	1.74	0.44	10.37	3.22	3.91	1.06	27.93
" 153	10.94	0.16	0.67	11.77	2.38	2.89	2.91	27.35
" 159	6.87	1.96	0.38	9.21	3.15	3.82	1.05	25.98
" 161	5.76	1.54	0.19	7.49	1.96	2.38	3.86	20.50
" 163	4.61	0.70	1.02	6.33	4.69	5.70	1.47	26.93
" 164	8.25	1.30	1.10	10.65	2.38	2.89	1.73	24.43
" 166	7.68	0.70	2.56	10.94	2.55	3.09	2.60	23.76
" 167	10.75	0.74	0.41	11.90	2.10	2.55	2.70	26.74
" 168	6.14	0.65	0.89	7.68	3.57	4.34	2.70	25.42
" 170	7.10	1.79	0.51	9.40	3.08	3.74	1.64	26.12
" 171	6.33	4.29	2.62	13.24	1.61	1.95	1.44	22.89
" 172	2.30	6.74	4.41	13.45	3.01	3.65	0.54	25.51
" 173	5.56	3.15	0.89	9.60	3.78	4.59	0.96	28.23

An inspection of the above will show the high character of the various brands now sold on our market.

ACID PHOSPHATES

Are Phosphates made soluble by treatment with Sulphuric Acid, and contain usually only one ingredient, viz.: Phosphoric Acid. This ingredient should be in a soluble or available form. There is a current belief that Phosphoric Acid from Bone is more valuable than that from Rock. This is true only in regard to the insoluble forms of Phosphoric Acid. Soluble and reverted Phosphates are of equal agricultural value, whether from Rock or Bone; and a good Acid Phosphate, whatever its source, should contain little or no Insoluble Phosphates.

ACID PHOSPHATES.

Station No. 141.—Sent by Planters' Fertilizer Co., New Orleans.
Station No. 142.—Sent by Planters' Fertilizer Co., New Orleans.
Station No. 150.—Sent by Planters' Fertilizer Co., New Orleans.
Station No. 155.—Sent by D. R. Calder, New Orleans.
Station No. 169.—Sent by Hon. Edward J. Gay, New Orleans.
Station No. 175.—Sent by Leon Godchaux, New Orleans.

ANALYSES OF ACID PHOSPHATES.

STATION.	Water Soluble Phosphoric Acid.	Citrate Soluble Phosphoric Acid.	Acid Soluble Phosphoric Acid.	Total Phosphoric Acid.	Potash	Relative Commercial Value.
No. 141	15.17	0.73	0.22	16.12	.....	$23.85
" 142	13.92	0.70	0.54	15.16	.....	21.93
" 150	16.27	0.31	1.66	18.24	.....	24.87
" 155	10.69	2.85	0.41	13.95	.....	20.31
" 169	14.01	1.93	0.38	16.32	.....	23.91
" 175	14.21	0.83	1.47	16.51	.....	22.56

COTTON SEED MEAL.

This is our cheapest and best source of Nitrogen. It is largely used all over Louisiana, as a fertilizer. Being a feed stuff, it is excluded from the provisions of the Fertilizer Law. Hence, great care is necessary in its purchase to see that it is well decorticated, *i. e.*, free from hulls. Pure, undamaged meal should be dry, pulverulent, and of a bright yellow color. Hulls in the meal can easily be detected by close examination, or by running a small quantity of the meal through a common kitchen sifter, when the hulls will separate. Damaged meal has a dark color, and while it is probably unfit for cattle food, it is rarely injured as a fertilizer. The commercial value of cotton seed, reckoned by our tariff, is far in excess of its actual value in New Orleans.

The best meal should always contain 7 per cent. Nitrogen, 3 per cent. Phosphoric Acid, and 2 per cent. Potash.

COTTON SEED MEAL.

Station No. 119.—Sent by R. Milliken, New Orleans, La.
Station No. 129.—Bought by Station from Maginnis Oil Works, New Orleans, La.
Station No. 151.—Sent by Trosclair & Robichaux, Thibodeaux, La.
Station No. 160.— —— —— —— ——
Station No. 174.—Sent by J. N. Pharr, Berwick City, La.

ANALYSES OF COT ON SEED MEAL.

STATION.	Total Phosphoric Acid.	Nitrogen.	Ammonia.	Potash.
No. 119	....	6.09	7.40	....
" 129	3.77	7.12	8.64	1.96
" 151	2.40	6.16	7.48	1.93
" 160	2.50	7.35	8.93	1.58
" 174	3.64	7.42	9.01	1.35

TANKAGE.

This fertilizer is growing in popularity in this State, and its extending use attests its supposed profitable results. It varies greatly in composition, as the analyses below will show. It is a refuse product of the slaughter house, and consists essentially of bone and meat which collects at the bottom of tanks in which the wastes of slaughter houses are cooked to extract the grease. When bone predominates, the Phosphoric Acid content is large and the Nitrogen small, and the action of both is slow. When meat is the chief ingredient, the per cent. of Nitrogen is large and the Phosphoric Acid low, and the action (especially of Nitrogen) is quite satisfactory.

The following samples were analyzed:

No. 124—Sugar Experiment Station, bought in New York.
No. 138—D. Thompson, Calumet Plantation, Pattersonville, La.
No. 139—D. Thompson, Calumet Plantation, Pattersonville, La.
No. 140—D. Thompson, Calumet Plantation, Pattersonville, La.
No. 154—Leon Godchaux, New Orleans, La.
No. 162—McCall & Legendre, McManor Plantation, Donaldsonville, La.
No. 165—McCall Bros., Evan Hall Plantation, Donaldsonville, La.

ANALYSES OF TANKAGE.

Station.	Phosphoric Acid.	Nitrogen.	Ammonia.	Relative Commercial Valuation.
No. 124	12.48	7.00	8.50	....
" 138	15.89	5.18	6.29	....
" 139	10.78	6.44	7.82	....
" 140	17.58	5.04	6.12	....
" 154	12.10	2.24	2.72	....
" 162	13.24	5.88	7.14	....
" 165	7.29	8.26	10.03	....

PHOSPHATES.

Under this head are included Orchilla Guano, Basic Phosphate Slag, and Bone Black.

Orchilla Guano is a natural deposit made by birds in a rainy climate. The Nitrogen and Soluble Phosphates have been removed, leaving only reduced and Insoluble Phosphates behind. It is essentially a phosphate of lime mixed with carbonate of lime.

Basic Phosphate Slag is the scoria which floats on the surface in the Thomas Gilchrist process of dephosphorizing pig iron. It is essentially a phosphate of lime mixed with lime, and on account of its porosity is susceptible of being ground into a very fine powder. It has proven of high agricultural value in some places.

Bone Black is the carbonized residue of bones which have been subjected to destructive distillation. It is largely used in sugar refineries, and, when spent, is sold to the manufacturers of commercial fertilizers, for treatment with acid. It is rarely applied without treatment to the soil, since each grain of Phosphate is surrounded by a thin layer of carbon which protects it from the solvent power of the soil.

PHOSPHATES.

Station No. 123.—Orchilla Guano; donated to the Station by the Agents.

Station No. 137.—Basic Phosphate Slag; from David Bryde, Glasgow, Scotland.

Station No. 145.—Basic Phosphate Slag; from A. A. Maginnis, New Orleans.

Station No. 143.—Bone Black; from J. C. Morris, New Orleans.

Station No. 144.—Bone Black; from Planters' Fertilizer Company, New Orleans.

ANALYSIS.

STATION.	Reduced Phosphoric Acid.	Insoluble Phosphoric Acid.	Total Phosphoric Acid.	
No. 123	4.22	15.36	19.58	Orchilla.
" 137	5.37	11.14	16.51	Basic Slag.
" 145	5.48	7.12	12.60	" "
" 143	....	....	28.42	Bone Black
" 144	....	....	27.10	" "

BAT MANURES,

The ordure of Bats, found in caves, roofs of houses, etc. When pure, it is an excellent manure; but the supply is always limited. The following samples were sent by R. Viterbò, Luling, La., and are from Texas:

ANALYSES OF BAT MANURES.

Station.	Phosphoric Acid.	Nitrogen	Ammonia.	Potash.
No. 156	8.92	4.90	5.95	1.59
" 157	4.70	9.24	11.22	1.25
" 158	9.02	4.90	5.95	1.13

BONE MEAL.

Bones ground to a powder are largely used in some countries as a fertilizer, and are held in high esteem. They are not popular in the South. The more finely ground they are, the higher their commercial value. Hence, in estimating their value, both a mechanical and chemical analysis are necessary. The sample analyzed was purchased by the Sugar Experiment Station, in New York, and cost $32.50 per ton.

ANALYSIS.

Station.	Phosphoric Acid.	Nitrogen.	Ammonia.
No. 122	20.93	3.78	4.19

And was in excellent mechanical condition.

FISH SCRAP

Is the dried and ground residue from the numerous works scattered along the Atlantic coast, engaged in extracting oil from fish. It contains a goodly percentage of both Nitrogen and Phosphoric Acid, and is often used to ammoniate many of the guanos, or complete fertilizers found in commerce. It is a cheap source of Nitrogen.

The sample analyzed was obtained in New York, and cost, there, $35.00 per ton.

ANALYSIS OF FISH SCRAP.

Station.	Phosphoric Acid.	Nitrogen.	Ammonia.
No. 126	3.52	7.14	8.67

The mechanical condition of Fish Scrap largely determines its agricultural value. To accomplish the best results, it should be very finely ground.

DRIED BLOOD

Occurs in commerce as black and red blood. The former has been prepared by drying the blood of slaughter-houses by superheated steam, the latter at a lower temperature. The former is often lumpy, and should be thoroughly pulverized before use. They both contain from 8 to 15 per cent. Nitrogen, and are usually sold upon a guarantee of so many units of ammonia. This is a most excellent source of Nitrogen. Field and labora. tory experiments have shown a slight degree of availability in favor of the red blood, due doubtless to its finer pulverization. The sample analyzed was black blood, and was bought by the Station from Mapes Fertilizer Company, New York. Price in New York, $47.50 per ton.

ANALYSIS OF DRIED BLOOD.

Station.	Phosphoric Acid.	Nitrogen.	Ammonia.
No. 126	0.70	13.79	16.75

SULPHATE OF AMMONIA

Is a by-product in the manufacture of gas from bituminous coal, and usually contains from 20 to 21 per cent. Nitrogen. It always carries a small amount of moisture. It is an excellent source of Nitrogen, but on account of its ready solubility in water, its use is restricted to the immediate wants of a plant; hence, like Nitrate of Soda, it is specially applicable as a top dressing to spring grains and grasses.

Our sample was obtained by the Station from Mapes Fertilizer Company, New York, and cost, in that city, $67.50 per ton.

ANALYSIS OF SULPHATE OF AMMONIA.

Station.	Nitrogen.	Ammonia.
No. 130	20.59	25.00

Equal to Sulphate of Ammonia, 97.06 per cent.

NITRATE OF SODA

Is a product of the mines of Peru and Chili, and is often called in commerce, Cubical, or Chilian Saltpetre. It is refined before shipment to this country. It contains, usually, about 16 per cent. Nitrogen. Small quantities of common salt and water, amounting to about 2 or 3 per cent., usually remains in this Fertilizer, reducing the Nitrate of Soda to 97 or 98 per cent. purity. Larger amounts of impurities would suggest adulteration or defect in refining. This Fertilizer is largely used as a top dressing for grains and grasses in the spring. It has also been successfully used for same purpose on cane. Its efficacy is always enhanced by addition of Acid Phosphate, and sometimes also by a salt of Potash.

The Sample analyzed was purchased of Mapes Fertilizer Company, New York, and cost, in that city, $47.50 per ton.

ANALYSIS OF NITRATE OF SODA.

Station.	Nitrogen.
No. 136	16.23

Equal to Nitrate of Soda, 98.53 per cent.

LIGNITE,

Or Brown Coal, was used in the sugar house for filtering cane juices. The sample analyzed came from Wood's Bluff, Clarke county, Ala., and was donated by Judge H. Austill, Mobile, Ala., to the Station, for trial, in 1886. An account of its action on cane juices has been published in a former Bulletin. The following is its composition :

Moisture	28.75 per cent.
Volatile Matter	29.45 per cent.
Fixed Carbon	28.85 per cent.
Ash	12.95 per cent.
Total	100.00 per cent.
Sulphur present	0.55 per cent.

OYSTER SHELL MARL.

A barrel of this marl was kindly donated to the Station by Mr. —— Keaney, New Orleans, to test its value in defecating cane juices. It is made from oyster shells, and can be sold to the planters for a price considerably below that usually paid for sugar lime. It is a remarkably pure lime, and excluding the partially decomposed shells, of which there was removed by a sieve an amount equal to 17.03 per cent., it served excellently in the defecation of juices.

The following is its composition:

Shells removed by sieve	17.03 per cent.
Moisture	1.20 per cent.
Carbon Dioxide	12.70 per cent.
Lime	68.10 per cent.
Magnesia	.12 per cent.
Insoluble Matter, Phosphoric Acid, etc	.85 per cent.
Total	100.00 per cent.

More completely burnt, or even finely pulverized after burning, would make this an excellent lime for defecation in the sugar house.

NER OF AGRICULTURE BY DEALERS AND MANU-
OR SEASON 1887–8.

UFACTURED.	Weight of package	NITROGEN.	PHOSPHORIC ACID. Soluble.	Reverted.	Insoluble.	POTASH.	Cash Price, per ton, to Farmers.
....	200	2 to 4	7 to 9	2 to 4	....	1½ to 3	....
....	200	2 to 3	6 to 8	3 to 4	....	2 to 3	....
....	200	....	12 to 16	1 to 3	....	....	....
....	200	....	14 to 18	1 to 2	....	....	....
....	200	4½ to 5	....	....	21 to 24	....	....
....	200	....	....	....	....	12 to 14	....
....	100	3½ to 4	7	1	....	2 to 3	$25.00
....	100	2½	9	1	....	2	....
....	100	4½ to 5	6	1	....	1½ to 2	....
....	100	4½ to 5	6	1	....	1 to 2	....
....	100	4 to 5	5	1	....	4 to 5	25 00
....	100	5 to 6	4	....	....	5	25.00
....	200	.82 to 1.64	....	8 to 9	3 to 4	2 16 to 3.24	....
ss	200	2.47	6.50	2.50	2.25	3.50	....
"	200	1.85	7	3	2	1	....
....	200	2¼ to 2½	5.50 to 6.50	3.50 to 4	1½ to 2½	1½ to 2¼	....
....	200	.75 to 1.50	7 to 9.50	3 to 4	1 to 2	1 to 2	....
....	200	....	8 to 9	5 to 6	2 to 2.75	....	....
....	200	....	7.50 to 8.50	4.50 to 5.50	1 to 2.50	2 to 3	....
'ds, Chicago..	200	1.64 to 2.46	5½ to 6½	2½ to 3	2 to 3	....	....
" " ..	200	1.64 to 2.46	5½ to 6½	2½ to 3	2½ to 3½	.54 to 1.08	....
" " ..	200	1.64 to 2 46	5½ to 6½	2½ to 3	2½ to 3½	.54 to 1.08	....
....	200	2½ to 3	9 to 11	....	2 to 3	....	28.00
....	200	6 to 8	....	....	12 to 14	....	23.00
....	200	3½ to 4	....	....	28 to 30	....	28.00
C............	200	2.06 to 6	6	2	1½	2	....
nd...........	168	7.4	....	11	....	2	....
C............	200	....	10	7	2	....	....

GUARANTEED ANALYSES OF COMMERCIAL FERTILIZERS, AS RENDERED TO COMMISSIONER OF AGRICULTURE BY DEALERS AND MANUFACTURERS TO WHOM LICENSES HAVE BEEN ISSUED FOR SEASON 1887–8.

Name of Fertilizer or Chemical.	By Whom Reported.		By Whom Manufactured.	Where Manufactured.	Weight of package	Nitrogen.	Phosphoric Acid.			Potash.	Cash Price, per ton, to Farmers.
	Name.	Address.					Soluble.	Reverted.	Insoluble.		
Soluble Guano	Standard Guano and Chem. M'f'g Co.	14 Union Street, N. O.	Standard Guano and Chem. M'f'g Co.	New Orleans	200	2 to 4	7 to 9	2 to 4	....	1½ to 3	....
Ammoniated Raw Bone Superphosphate	" " " " " " "	" " "	" " " " " " "	" "	200	2 to 3	6 to 8	3 to 4	....	2 to 3	....
Acid Phosphate	" " " " " " "	" " "	" " " " " " "	" "	200	....	12 to 16	1 to 3	....	....	....
Stern's Dissolved Bone	" " " " " " "	" " "	" " " " " " "	" "	200	....	14 to 18	1 to 2	....	....	....
Stern's Pure Ground Bone	" " " " " " "	" " "	" " " " " " "	" "	200	4½ to 5	....	....	21 to 24	....	....
Stern's Kainit	" " " " " " "	" " "	" " " " " " "	" "	200	....	....	....	....	12 to 14	....
Sugar Fertilizer	Planter's Fertilizer Manuf'g Co	113 Magazine Street, N. O.	Planters' Fertilizer Manuf'g Co.	" "	100	3½ to 4	7	1	....	2 to 3	$25.00
Cotton "	" " " "	" " " "	" " " "	" "	100	2½	9	1	....	2	....
Oats "	" " " "	" " " "	" " " "	" "	100	4½ to 5	6	1	....	1½ to 2	....
Rice "	" " " "	" " " "	" " " "	" "	100	4½ to 5	6	1	....	1 to 2	....
Fruit Tree "	" " " "	" " " "	" " " "	" "	100	4 to 5	5	1	....	4 to 5	25 00
Vegetable "	" " " "	" " " "	" " " "	" "	100	5 to 6	4	....	....	5	25.00
Sol. Stern's Fertilizer	Sol. Stern ——	78 Decatur Street, N. O.	Farmers' Fertilizer Manuf'g Co.	Syracuse, N. Y.	200	.82 to 1.64	....	8 to 9	3 to 4	2 16 to 3.24	....
Soluble Pacific Guano, sugar grade	W. P. Richardson,	33 Carondelet Street, N.O.	Pacific Guano Company	Wood Holl, Mass	200	2.47	6.50	2.50	2.25	3.50	....
Cotton Grade Guano	for Glidden & Curtis.	and Boston, Mass.	" " "	" " "	200	1.85	7	3	2	1	....
Gossipium Phospho	G. W. Scott Manufacturing Company	Atlanta, Georgia	G W. Scott Manufacturing Co.	Atlanta, Ga	200	2¼ to 2½	5.50 to 6.50	3.50 to 4	1½ to 2½	1½ to 2¼	....
Scott's Animal Ammoniated Guano	" " " "	" "	" " " "	" "	200	.75 to 1.50	7 to 9.50	3 to 4	1 to 2	1 to 2	....
Scott's High-grade Acid Phosphates	" " " "	" "	" " " "	" "	200	....	8 to 9	5 to 6	2 to 2.75	....	....
Scott's Potasso Phospho	" " " "	" "	" " " "	" "	200	....	7.50 to 8.50	4.50 to 5.50	1 to 2.50	2 to 3	....
National Bone Dust	Northwestern Fertilizer Company	Chicago, Illinois	Northwestern Fertilizer Co	Union Stock Y'ds, Chicago	200	1.64 to 2.46	5½ to 6½	2½ to 3	2 to 3	....	....
Ammoniated Dissolved Bone	" " "	" "	" " "	" " " " "	200	1.64 to 2.46	5½ to 6½	2½ to 3	2½ to 3½	.54 to 1.08	....
Garden City Superphosphate	" " "	" "	" " "	" " " " "	200	1.64 to 2 46	5½ to 6½	2½ to 3	2½ to 3½	.54 to 1.08	....
Studnitzka's Standard Sugar Fertilizer	Henry Studnitzka & Co	41 North Peters Street, N. O.	Armour & Co	Chicago, Ill	200	2½ to 3	9 to 11	....	2 to 3	....	28.00
Hog Tankage	" " "	" " " " "	" " "	" "	200	6 to 8	....	....	12 to 14	....	23.00
Powdered Raw Bone	" " "	" " " " "	" " "	" "	200	3½ to 4	....	....	28 to 30	....	28.00
Atlantic Soluble Guano	Pelzer, Rodgers & Co	Charleston, S. C.	Atlantic Phosphate Co	Charleston, S. C	200	2.06 to 6	6	2	1½	2	....
Peruvian Guano	C. C. Crawford	6 Tchoupitoulas Street, N. O.	Anglo-Continental Guano Works	London, England	168	7.4	....	11	....	2	....
Atlantic Dissolved Bone	Pelzer, Rodgers & Co	Charleston, S. C.	Atlantic Phosphate Company	Charleston, S. C	200	....	10	7	2	....	....

SORGHUM.

FIELD, LABORATORY AND SUGAR-HOUSE RESULTS

DIFFUSION PROCESS.

BULLETIN No. 19

—OF—

THE LOUISIANA

STATE EXPERIMENT STATION.

WM. C. STUBBS, Ph. D., Director.

—Issued by—
THOMPSON J. BIRD,
COMMISSIONER OF AGRICULTURE,
BATON ROUGE, LA.

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1888.

SUGAR EXPERIMENT STATION,
KENNER, LA., December 15, 1888.

To His Excellency Francis T. Nicholls, Governor of Louisiana; Mr. William Garig, Vice-President Board of Supervisors of the Louisiana State University and Agricultural and Mechanical College; and Hon. Thompson J. Bird, Commissioner of Agriculture, Baton Rouge, La.:

Gentlemen—To you, constituting the "Bureau of Agriculture" of the State of Louisiana, the Stations are indebted for the larger portion of the means by which the experiments in Diffusion of Sorghum have been, recently, made. I therefore transmit to you a full report of results, and ask that it be published by Commissioner T. J. Bird, as Bulletin No. 19.

Thanking you for your active co-operation, I am

Respectfully yours,

WM. C. STUBBS,

Director.

Report of Sugar Experiment Station on Sorghum.

On April 6th, 1888, two plats (Nos. 9 and 10) at the Sugar Experiment Station were planted in sorghum.

PREVIOUS CULTURE.

No. 9 had been continuously in sorghum since 1886, and No. 10 in corn.

PREPARATION OF LAND.

The land was broken in the spring with 4-horse plows, thrown into beds five feet apart, and seed sown and lightly harrowed in. Only a partial stand was secured, germination being prevented by a prevailing drouth. It was thinned, wherever it was thick enough, to three stalks to the running foot. The cultivation consisted of off-barring with a 2 horse plow, a hoeing, and returning the dirt with a 2-horse plow, and breaking out the middles with a large one and a three-quarter Avery advance double mould-board plow.

The excessive rains began in May and lasted till the middle of July, and prevented further cultivation.

The varieties planted on these plats were:

1. Honduras, seed grown at the Station.
2. Honduras, seed grown on the Teche.
3. Link's Hybrid, seed grown in Kansas.
4. White's Mammoth, seed grown at the Station.
5. White India, seed grown in Kansas.
6. Enyama, grown by J. P. Baldwin of the Teche.

7. Early Orange, grown in Kansas.
8. Kansas Orange, grown in Kansas.
9. New Orange, grown in Kansas.
10. Golden Rod, grown in Kansas.
11. Honey Drip, grown in Kansas.
12. Texas Honey Drip, seed bought of Gumbrell, Reynolds and Allen, Kansas City, Mo.
13. Planted with seed from Department of Agriculture, but none came up.
14. White Minnesota, amber seed, grown in Nebraska.
15. Early Amber, seed grown in Kansas.
16. Early Amber, seed furnished by the Department of Agriculture.
17. Kansas Orange, seed from Kansas.
18. Link's Hybrid, seed grown at the Station.
19. Early Orange, seed grown at the Station.

Several of the above varieties were sent to the State Experiment Station, Baton Rouge, La., and to the North Louisiana Experiment Station, Calhoun, La.; and experimental plats were planted at each station.

The varieties planted at Baton Rouge were Early Amber, Early Orange, Link's Hybrid and Honduras.

They were planted in rows four feet wide, and seed lightly covered. The cultivation was the same as that given to corn, after thinning it to a stand of one stalk to every four inches.

The storm of 19th of August completely prostrated the canes, and on September 12th the field was green with a luxuriant growth of suckers.

The varieties grown at the North Louisiana Experiment Station, Calhoun, La., were:

No. 1. Minnesota Early Amber, seed from Nebraska.
No. 2. Early Amber, seed from Department of Agriculture.
No. 3. Early Orange, seed from Department of Agriculture.
No. 4. New Orange, seed from Kansas.
No. 5. White India, seed from Sugar Experiment Station.
No. 6. Link's Hybrid, seed from Sugar Experiment Station.
No. 7. Golden Rod, seed from Kansas.

These were planted on April 18th, thinned to a stand, and cultivated in its order with the corn crop. Here flat cultivation was exclusively practiced during the season, while at the other two stations high ridges were required for drainage.

These plantings were made with a view of testing, by mill and laboratory experiments, the adaptability of sorghum as a sugar crop to Louisiana. If sugar can be made profitably from sorghum anywhere in the United States, it should be done in Louisiana. Chemical analyses show a larger percentage of sugar and a smaller quantity of glucose in sorghum grown in Louisiana than anywhere else in this country. At least the published analyses now at hand verify this assertion. Again, could our sugar planters be persuaded that sorghum could be made to yield a profitable quantity of sugar, say even 1000 pounds per acre, they would soon abopt it as an adjunct to the cane crop. Once establish the fact that sugar can be profitably made from sorghum, and it will become exceedingly popular with all cane-growers, for the following reasons:

1st. By planting different varieties and at different times it can be made to ripen in Louisiana at any time from July to November, thus giving employment six months to an expensive machinery, which is now engaged only sixty days in grinding the cane crop.

2d. The cost of seed required to plant a crop of sorghum is vvery small—quite insignificant compared with the large amount required for cane.

3d. The ease and cheapness with which this crop can be grown.

4th. The value of the seed for forage—a by-product without cost, save the expense of carefully housing.

Again, there are vast tracts of rich alluvial lands in the middle and northern portion of the State which are too far north for cane and which will grow excellent crops of sorghum. These lands are now in cotton, but could it be demonstrated that they could grow sorghum profitably, central factories would spring up in every direction and this crop would supplant cotton in part, if not entirely.

With these possibilities in view, the Director has persistently planted sorghum for three years upon the Sugar Experiment Station, and has attempted every year to make, successfully, sugar from it by the milling process. Chemical analyses have shown that our juices were rich in sucrose and low in glucose, but our sugar-house experiments have failed to extract it successfully. We have made the *massé cuite* full of grains, but our centrifugals failed to purge. All this was due to the starch present in the juice (extracted by pressure with the mill), which, during the subsequent process of concentration, was converted into dextrine, and this substance, our *bete noir*, prevented the elimination of the sugar. Our past experiments have demonstrated the inapplicability of the crushing mill to sorghum. They have also shown that high temperatures must be avoided. Therefore, new methods of extracting the juice and processes of cooking in vacuo must be resorted to before we can successfully extract sugar from sorghum.

Fort Scott, Kansas, and Rio Grande, New Jersey, have both demonstrated that diffusion was applicable to the extraction of juice, and goodly quantities of sugar had thus been obtained. After planting the above crops, the Bureau of Agriculture, which has immediate control of the stations, received a petition in the form of a series of resolutions from the Ascension branch of the Sugar Planters' Association, asking that it make an appropriation for the purpose of erecting a diffusion battery for sorghum, and to continue the experiments so auspiciously begun at Fort Scott and Rio Grande. The planters were anxious to know if the flattering results obtained in Kansas could not be realized here. The Bureau having received at one time the deferred half of the annual Hatch appropriation, decided to grant the request, so far as the limited means at their disposal would permit. Accordingly it passed a series of resolutions appropriating money for the enterprise, and authorizing the Director to proceed at once to obtain the necessary machinery.

As soon as these resolutions were passed, increased areas were planted in sorghum at each station, using seed received from Kansas, at Kenner, and Early Amber and Orange at the other two.

Acting under these resolutions, bids were invited for building (1), a "diffusion battery of fourteen cells, capacity of battery one and a half to two tons per hour; (2), a double effect of four hundred square feet of heating surface." Messrs. Edwards & Haubtman, of New Orleans, making the best proposition for the erection of above machinery was accorded the contract.

Mr. J. P. Baldwin, of St. Mary parish, who had formerly been an attache of the station, and who has great mechanical ingenuity, was employed in May to superintend the erection of the machinery, and after full and free conference with him and Mr. E. W. Deming, late engineer in charge of the Fort Scott sugar-works, and now supervising engineer of the Conway Springs Sugar-works, Kansas, the following machinery was ordered:

Cutter and comminutor or pulper, with shafting and pulleys, from George J. Fritz, St. Louis, Mo.; conveyors, elevators and gearing from the Link Belt Company, Chicago; and Mr. E. W. Deming kindly superintended the construction of a fan, a duplicate of the one made for Conway Springs Sugar-works, which he shipped us from Kansas.

Considerable work had to be done to conform the old sugar-house to its new machinery. Indeed, the task of planning and transforming the old conditions to the new was one requiring patience, energy and excellent mechanical ingenuity. That it has been well done is the universal testimony of all visitors.

After the above work had been contracted for, the gratifying intelligence was received from the Hon. Norman J. Colman, Commissioner of Agriculture, Washington, D. C., that he would allow this Station five thousand dollars of the one hundred thousand recently appropriated by Congress for experiments in making sugar from sorghum. This supplement to the appropriation from the Bureau of Agriculture has enabled this Station to enlarge its equipment and extend its field of investigation.

From our past experience with sorghum, it was inferred that our crop, planted on the 16th of April, would not be ready for the sugar-house before the 1st of September. Accordingly we contracted with Messrs. Edwards & Haubtman to deliver the machinery by the 15th of August, thus giving us fifteen days

(ample time) for its erection and preparation for work. Messrs. Edward & Haubtman failed to deliver until the 23d of August, which failure, in connection with the unprecedented storm of the 19th of that month, which completely prostrated our sorghum, proved most disastrous to our successful manufacture of sugar.

In 1886, sorghum planted April 5th was harvested the 13th September. In 1887, sorghum planted April 21st was worked up September 23d. Both years they were worked at full maturity, excepting the Early Amber and Chinese, which were ripe in July of each year.

It was fair, therefore, to calculate that without any natural intervention the sorghum this year would not have been ready for the sugar-house before the middle of September; and had not the storm prevailed, the date of delivery of Messrs. Edwards & Haubtman would have still afforded us ample time to have completed erection before the maturity of the crop. Either, alone, would not have proved disastrous; both, together, were fatal. [See chemical analysis, further on, for verification.]

Of the varieties mentioned above, the Ambers were ripe in July, and accordingly were worked up by the mill, cooked to masse cuite, and left in hot room for comparison with masse cuite from diffusion juice.

LABORATORY WORK.

During the summer the laboratory has been engaged in the study of the chemistry of sorghum. To this end weekly analyses of all varieties have been made and daily study prosecuted as to the physiological changes occurring in the growth and maturity of sorghum. The following are the notes made by my assistant, Mr. W. L. Hutchinson, up to September 1st, at which time he resigned to accept the professorship in chemistry in the Agricultural and Mechanical College of Mississippi. His leaving put an end to his interesting investigations.

June 21st.—Iodine shows no starch in Minnesota White Amber, just headed. Single polarization gives no sucrose.

The following were found: Glucose, 3.65 per cent.; solids, 6.66 per cent.; albuminoids, .17 per cent.

The precipitate produced by subacetate of lead, after being freed from the lead, gave no trace of oxalic acid, but a quantity of tartaric acid. So great was the latter that every attempt at its entire removal failed, so that no positive conclusions as to the other acids present were drawn.

On July 16, fully matured samples of Early Amber were obtained, the juice extracted and subjected to analysis. The sucrose was determined by single and double polarization and by Fehling's solution. The following are the results:

Sucrose: Total solids, 16.58; single polarization, 12.31; double, 12.28; Fehling's, 12.22. This juice was concentrated to syrup, and the latter gave, by single polarization, sucrose 52.41; double polarization, 53.58.

STARCH IN SORGHUM.

With green canes just heading no indications of starch are given by iodine. If there were any blue it was completely obscured by the intensely brown coloration. This brown coloration indicated dextrine and other forms of soluble starch.

With well-matured canes iodine gives an intensely blue color towards the top, decreasing in intensity towards the butt. Canes occupying an intermediate condition between these extremes, or in that stage of growth when maturity begins to appear, as indicated by the presence of sucrose in the lower part of the stalk, starch will be found in the butt but not in the top.

The above conclusions of Mr. Hutchinson have been fully confirmed by subsequent experiments; and it is not unusual in our laboratory now to prognosticate the amount of sucrose in a cane by the presence of starch, so intimately are they associated. Both sucrose and starch seem to be formed simultaneously—the former from glucose and perhaps other bodies, and the latter from dextrine and other soluble forms.

Glucose occurs in largest quantities when the polariscope gives no indication of sucrose by single polarization. In a sample

of green cane, in which there was no starch, and by single polarization no sucrose, but by double polarization 1.53 per cent., as high as 7 per cent. of glucose was found. As the cane, from which the above sample was selected, matured, repeated analysis made at short intervals showed that the glucose decreased, until at maturity it reached as low 0.8 per cent.

SINGLE VS. DOUBLE POLARIZATION.

In juices from matured canes, there is a very close agreement between the sucrose obtained by single and double polarization. Not so with the immature canes, and the greater the immaturity the greater the disagreement. In all of the laboratory work on samples taken from the field, sucrose was therefore determined by single and double polarization.

ANALYSES OF VARIETIES OF SORGHUM.

These were begun on July 11, and continued weekly until worked up. Tho following table gives the results:

ANALYSES OF THE VARIETIES OF SORGHUM AT DIFFERENT STAGES OF GROWTH.

Date of Analysis.	Total Solids.	Sucrose — Single polarization.	Sucrose — Double polarization.	Glucose.	Variety.	Number of Experiment.
July 11..	9.8	2.2	3.22	2.95	Early Orange......	19
Aug. 6..	16.6	12.4	12.40	1.00	" "	19
" 13..	16.	12.3	12.60	.76	" "	19
" 20..	16.5	12.1	12.24	.60	" "	19
" 27..	16.3	12.2	12.52	.73	" "	19
Sept. 4..	15.7	11.7	12 85	1.23	" "	19
" 8..	14.5	10.2	.....	1.05	" "	19
July 11..	11.5	5.2	6.22	3.20	Link's Hybrid......	18
" 19..	12.68	8.3	.....	1.64	" "	18
Aug. 6..	16.20	12.2	12.10	1.28	" "	18
" 13..	13.20	10.	10.06	1.27	" "	18
" 20..	16.10	12.	12.07	.74	" "	18
" 27..	16.20	12.	12.28	.86	" "	18
Sept. 4..	15.30	12.	12.00	.95	" "	18
" 12..	11.40	7.9	.....	.99	" "	18
July 11..	11.80	4.1	5 12	3.40	Kansas Orange.....	17
Aug. 6..	16.90	12.	12.00	1.13	" "	17
" 13..	15.60	11.6	11.63	1.45	" "	17
" 20..	16.80	11.7	11.67	2.78	" "	17
" 27..	15.20	11.1	11.33	1.33	" "	17
Sept. 4..	13.70	9.7	9.67	1.98	" "	17
" 12..	11.60	8.1	....	1.43	" "	17
July 11..	13.30	8.3	8.95	2.85	Early Amber, Nebraska, ...	16
" 19..	15.70	12.1	....	1.20	" "	16
" 26..	14.80	11.0	....	1.18	" "	16
" 30..	17.20	12.3	....	1.74	" "	16
July 11..	13.60	8.4	9.20	2.75	Early Amber, Kan..	15
" 26..	15.70	12.0	....	1.13	" " " ..	15
" 30..	16.73	12.1	....	1.70	" " " ..	15
July 11..	13.2	7.0	7.78	3.71	Early Amber, Dep't of Ag.	14
" 26..	17.5	13.5	....	1.00	" "	14
" 30..	16.3	11.6	...	1.59	" "	14
July 11..	8.9	....	1.53	6.34	Texas Honey Drip..	12
" 20..	10.57	3.3	....	4.85	" " " ..	12
Aug. 6..	12.10	5.8	5.41	2.99	" " " ..	12
" 13..	11.8	7.9	8.25	2.20	" " " ..	12
" 20..	14.3	9.5	9.79	2.51	" " " ..	12
" 27..	13.2	9.3	9.25	2.78	" " " ..	12
Sept. 4 ..	12.8	9.5	9.53	2.78	" " " ..	12
" 12..	10.4	7.7	....	2.17	" " " ..	12
July 11..	11.1	6.2	8.89	1.70	Honey Drip........	11
" 20..	11.01	5.0	....	4.25	" "	11
Aug. 7..	10.1	5.8	5.41	2.99	" "	11
" 13..	11.8	7.9	8.25	2.20	" "	11
" 20..	11.8	6.6	6.93	1.97	" "	11
" 27..	14.9	11.0	11.08	.80	" "	11

ANALYSES OF THE VARIETIES OF SORGHUM AT DIFFERENT STAGES OF GROWTH—CONTINUED.

Date of Analysis.	Total Solids.	Sucrose—Single polarization.	Sucrose—Double polarization.	Glucose.	Variety.	Number of Experiment.
Sept. 4..	8 6	5.5	5.45	1.47	Honey Drip........	11
" 12..	9.5	4.9	....	2 22	" "	11
July 11..	8.5	2.0	4.18	3.40	Golden Rod........	10
" 20..	....	6.5	....	2.00	" "	10
Aug. 7..	13.6	8.0	8.71	1.63	" "	10
" 13..	13.3	7.0	7.39	2.45	" "	10
" 20..	11.7	6.3	6.50	1.21	" "	10
" 27..	10.2	5.5	6.05	.81	" "	10
Sept. 4..	10.2	5.6	5.62	1.47	" "	10
" 12..	9.5	4.9	....	2.35	" "	10
July 11..	13.3	6.9	8.81	4.25	New Orange........	9
" 20..	16.3	11.0	....	2.83	" "	9
Aug. 7..	13.80	10.3	10.36	1.68	" "	9
" 13..	12.50	8.8	8.92	1.71	" "	9
" 20..	12.20	6.9	7.33	2.94	" "	9
" 27..	12.20	8.	8.16	2.82	" "	9
Sept. 4..	10.20	6.2	6.20	2.68	" "	9
" 12..	9.10	7.1	....	2.54	" "	9
July 11..	10.60	4.8	6.67	2.68	Kansas Orange.....	8
" 20..	13.11	8.2	....	2.21	" "	8
Aug. 7..	13.90	8.	8.8	1.83	" "	8
" 13..	14.8	10.6	10.74	1.36	" "	8
" 20..	12.7	8.1	8.35	1.37	" "	8
" 27..	13.1	7.9	8.0	1.71	" "	8
Sept. 4..	10.1	6.5	6.74	2.15	" "	8
" 12..	....	5.3	....	1.60	" "	8
July 11..	11.7	6.0	7.51	2.43	Early Orange......	7
" 20..	11.71	7.2	....	2.21	" "	7
Aug. 7..	11.0	7.8	7.10	1.77	" "	7
" 13..	....	11.0	11.18	1.90	" "	7
" 20..	14.3	9.0	9.31	1.71	" "	7
" 27..	12.3	9.5	9.49	1.72	" "	7
Sept. 4..	10.9	7.1	7.21	1.92	" "	7
" 12..	8.1	4.9	....	1.95	" "	7
July 11..	9.	2.3	3.95	2.12	Enyama	6
" 20..	9.71	4.8	....	2.31	"	6
Aug. 7..	14.80	10.0	10.80	1.14	"	6
" 13..	13 20	9.0	9.18	1.43	"	6
" 20..	14.70	10.6	10.88	1.08	"	6
" 27..	14.60	10.5	10.50	.82	"	6
Sept. 4..	8.5	5.2	5.05	1.47	"	6
" 12..	....	6.5	....	.54	"	6
July 11..	10.9	5.4	6.9	1.82	White India	5
" 20..	14.83	11.0	....	1.70	" "	5
Aug. 7..	14.60	10.2	11.0	1.14	" "	5
" 13..	13.50	9.5	9.9	1.59	" "	5
" 20..	10.30	6.6	7.01	2.36	" "	5
" 27..	13.6	9.20	9.18	.72	" "	5

ANALYSES OF THE VARIETIES OF SORGHUM AT DIFFERENT STAGES OF GROWTH—CONTINUED.

Date of Analysis.	Total Solids	Sucrose — Single polarization	Sucrose — Double polarization.	Glucose.	Varieties.	Number of Experiment.
Sept. 4..	13.	9.90	9.80	1.27	White India	5
" 20..	14.1	10.00	....	1.25	" "	5
July 11..	6.5	.4	2.00	3.29	White Mammoth...	4
" 20..	7.91	2.6	....	3.00	" " ...	4
Aug. 7..	14.20	9.6	9.71	1.43	" " ...	4
" 13..	10.5	6.0	6.40	2.30	" " ...	4
" 20..	10.2	6.1	6.54	1.87	" " ...	4
" 27..	12.2	7.7	7.84	.87	" " ...	4
Sept. 4..	8.1	5.7	5.06	2.00	" " ...	4
" 20..	10.5	6.9	....	2.14	" " ...	4
July 11..	9.8	4.8	5.78	1.59	Link's Hybrid	3
" 20..	9.1	4.0	....	2.55	" "	3
Aug. 7..	14.9	9.0	9.53	2.34	" "	3
" 13..	14.5	10.1	10.21	.74	" "	3
" 20..	13.7	9.2	9.55	1.14	" "	3
" 27..	13.7	10.5	10.50	.78	" "	3
Sept. 4..	12.2	9.1	9.10	1.00	" "	3
" 20..	10.6	6.7	....	1.48	" "	3
July 11..	7.0	2.0	2.96	1.9	Honduras..........	2
" 20..	7.81	3.4	....	3.00	"	2
Aug. 7..	9.70	3.6	4.80	2.14	"	2
" 13..	7.10	3.4	3.52	2.76	"	2
" 20..	7.70	2.5	3.05	2.53	"	2
" 27..	....	7.1	7.12	1.94	"	2
Sept. 4..	7.6	5.0	4.99	2.11	"	2
July 11..	6.8	1.0	1.81	3.40	"	1
" 20..	8.81	4.4	....	3.09	"	1
Aug 7..	10.80	6.2	7.79	1.83	"	1
" 13..	9.20	5.8	5.83	1.50	"	1
" 20..	9.20	4.0	3.87	3.14	"	1
" 27..	10.50	6.6	6.82	1.79	"	1
Sept. 4..	8.0	5.4	5.46	1.74	"	1
" 12..	10.	6.0	....	2.27	"	1

ANALYSES OF VARIETIES OF SORGHUM GROWN AT BATON ROUGE, LA.

Date of Analysis.	Total Solids.	Sucrose, (Single polarization.)	Glucose.	Variety.
Aug. 6	....	12.00	....	Early Amber.
" 9	15.9	9.50	3.80	" "
" 14	18.1	13.40	1.12	" "
" 28	17.0	12.10	1.09	" "
Sept. 11	14.7	7.30	1.82	" "
Aug. 6	....	11.20	....	Early Orange.
" 14	15.9	10.00	2.38	" "
" 28	17.0	12.40	2.07	" "
Sept. 11	11.9	7.8	4.52	" "
Aug. 6	....	9.4	....	Link's Hybrid.
" 9	16.1	11.5	1.87	" "
" 14	16.4	10.5	3.00	" "
" 6	....	6.3	....	Honduras.
" 9	15.8	8.4	4.70	"
" 14	11.6	4.1	5.47	"

ANALYSES OF VARIETIES GROWN AT LOUISIANA EXPERIMENT STATION, CALHOUN, LA.

Date of Analysis.	Total Solids.	Sucrose, (Single polarization.)	Glucose.	Variety.
Oct. 1	....	11.4	1.27	Early Amber.
" 1	....	11.8	2.56	Early Orange.
" 1	....	10.5	2.20	New Orange.
" 1	....	12.3	1.56	Link's Hybrid.
" 1	....	....	87	White India.
" 1	....	10.6	1.36	Golden Rod.

An inspection of above tables will show that Early Amber reached its maximum in July, say 100 days after planting. Golden Rod and Honduras never reached maturity, the storm of August 19th prostrating them before the maximum of sugar was reached. The other varieties attained their maximum during August.

Could these experiments have been worked during August, it is believed that most excellent results would have been attained. Up to September 4th, just as suckers began to appear at each joint on the prostrated cane, the latter had lost but little in sucrose since the storm of the 19th of August. After the suckers began to grow, the loss was rapid and heavy, as is shown by the mill juices of September 8th to 20th.

The canes at Calhoun were not injured, the storm not extending as far north as this Station. They have therefore preserved their sugar up to October 1st, and suffered little or no loss.

Experiments in Diffusion.

All the machinery being in position and ready for use, a trial run was made on September 8th, using the Early Orange variety. The cutters did their work well, so did the diffusion cells, except now and then a leak, which was easily closed. The larger heater which heated the juice before entering the cells was out of order and could not be used either in this or the next trial. The fan which had been furnished as adapted to the cleaning of sorghum chips, failed utterly to do its work. The shaker which was geared to the fan ran too rapidly, and had to be run by an independent pulley, at a slower motion. The depth of the shaker was far too narrow, so much so that the chips of cane thrown violently forward by the force of the cut were often propelled beyond the shaker and fell into the trash. In this way a large amount of cane in this experiment was lost. The shaker was lengthened and many other improvements made until good work was accomplished. On account of these defects only 1152 pounds of sorghum (with tops and blades) were used, and only two cells of the battery were filled. The following are the laboratory analyses:

	Total Solids.	Sucrose.	Glucose.	Ratio of Sucrose to Glucose.
Mill juice	14.6	10.2	1.05	10.25
Diffusion juice—				
First cell............	....	1.1	.1021	9.11
Second cell..........	....	.7	.0638	9.11

No sugar or syrup made.

Pending the making of the necessary improvements to the fan and shaker the cubical contents of the cells were calculated in the following manner: The cells were filled with water and then the water carefully emptied into a sugar-wagon and weighed, allowing 62½ pounds of water to a cubic foot. Each cell contained 13.52 cubic feet. A cell packed with sorghum chips and

one put in without packing were also emptied and weighed. Their weights were, respectively, 353 pounds and 276 pounds, making 26 pounds and 20 pounds per cubic foot.

Without entering into the full details of daily work, the following taken from our records will suffice to fully illustrate the work performed.

Considering the very low character of the sorghum worked, the results are quite satisfactory.

Monday, September 10th, 1888—Another trial of the machinery was made to-day to decide whether the improvements so hastily made were effective. Honduras sorghum was used; weight, with tops and blades, 2158 pounds. Everything worked fairly well. It was found that both the cutter and comminutor were projecting the chips in every direction, thus causing great waste. A stop was made and these boxed in. Four cells were, however, filled and the juices from these concentrated in the double effect and left in the latter all night. The next morning, to our surprise, we found that one of the tubes of the double effect had leaked during the night and had diluted the syrup almost to the original juice. Accordingly it was withdrawn and thrown away, and the leaking tube plugged up. The laboratory results are given:

	Sucrose.	Glucose.	Ratio of Sucrose to Glucose.
Mill juice	4.2	2.51	58.3
Diffusion juice—			
First cell	1.3	.43	....
Second cell	1.3	.38	....
Third cell	2.3	.76	....
Fourth cell	1.4	.55	....

Wednesday, September 12th.—Having repaired the defects work was begun at 9:30 o'clock and continued until nineteen cells had been filled. Everything worked admirably, except the heaters which were not under control, and hence varying temperature used in diffusing. Weather very warm and much suffering experienced by everybody at work, particularly by the men at the diffusors and clarifier.

The following canes, with quantities, were used:

Link's Hybrid,	with tops and blades	....	1,292 pounds.
Kansas Orange,	" "	....	900 pounds.
Texas Honey Drip,	" "	....	1,214 pounds.
Honduras,	" "	....	470 pounds.
Honey Drip,	" "	....	828 pounds.
Golden Rod,	" "	....	1,096 pounds.
New Orange,	" "	....	1,072 pounds.
Kansas Orange,	" "	....	829 pounds.
Early Orange,	" "	....	1,370 pounds.
Total		....	9,071 pounds.

Less tops....... 1,403 pounds } =28.46 per cent.—2,582 pounds.
" trash...... 1,179 pounds }

Clean cane diffused.............................. 6,489 pounds.

The chips packed in very tightly, and failed to discharge easily. Drew the first juice off at cell No. 7, and continued to draw until twenty-five discharges had been made, viz: Nos. 7, 8, 9, 10, 11, 12, 13, 14, 1, 2, 3, 4, 5, 8, 9, 10, 11, 12, 13, 14. 1, 2, 3, 4, and 5.

The juice from No. 7 passed over seven fresh chips.

The juice from No. 8 passed over seven second chips and one fresh chip.

The juice from No. 9 passed over seven third chips, one second chip and one fresh chip.

The juice from No. 10 passed over seven fourth chips, one third chips, one second chip, and and one fresh chip, etc., until the 14th cell was reached. While No. 14 was being filled, No. 1 was emptied. Then began regular diffusion. The 20th cell was partially filled, but not used, and No. 21 was at the same time emptied. Hence the absence of Nos. 6 and 7 in the discharges above.

The following analyses were made:

1. Mill juices of each variety used.
2. Diffusion juices from each cell.
3. Chips as they were emptied from each cell.
4. Clarified juice from each clarifier.
5. Syrup.
6. Residuum scum.
7. Sugar.
8. Molasses.

The following are the results:

MILL JUICES.

Variety.	Total Solids.	Sucrose.	Glucose.
Link's Hybrid	11.4	7.9	.99
Kansas Orange	11.6	8.1	1.43
Honey Drip	10.4	7.7	2.17
Honduras	10.0	6.0	2.27
Golden Rod	9.5	4.9	2.38
New Orange	9.1	7.1	2.54
Kansas Orange	....	5.3	1.60
Early Orange	8.1	4.9	1.95
Enyama	....	6.5	.54

DIFFUSION CHIPS

	Sucrose.	
1st	1.4	....
2d	.6	....
3d	.5	....
4th	.6	....
5th	.2	....
6th with 12 washings	.55	....
7th " 11 "	.75	....
8th " 10 "	.85	....
9th " 9 "	1.10	....
10th " 8 "	.8	....
11th " 7 "	.7	....
12th " 6 "	.5	....
13th " 5 "	.6	....
14th " 4 "	1.2	....
15th " 3 "	.7	....
16th " 2 "	1.5	....
17th " 1 "	sample lost.	

DIFFUSION JUICES.

	Total Solids.	Sucrose.	Glucose.
From 1st discharge	6.4	4.2	1.11
" 2d "	5.5	3.8	1.12
" 3d " " 4th "	4.1	3.0	.53
" 5th " " 6th "	4.1	3.1	1.19
" 7th "	5.9	3.8	1.56
" 8th "	5.1	3.7	1.40
" 9th "	5.6	3.9	1.39
" 10th, and subsequent	4.7	3.3	1.56

CLARIFIED JUICES.

	Total Solids.	Sucrose.	Glucose.
No. 1	4.5	3.4	1.06
No. 2	4.9	3.3	1.26
No. 3	2.8	2.2	....
No. 4	2.2	1.7	.65

SYRUP.

Total Solids.	Sucrose.	Glucose
32.20	17.5	7.35

SCUMS.

Total Solids.	Sucrose.	Glucose.
4.10	1.9	.83

SUGAR.

Sucrose.	Glucose.
91.2	2.85

MOLASSES.

Sucrose.	Glucose.
30.4	14.28

It was utterly impossible from the varying amount of sucrose in the canes used, to get anything like uniform results, either on the juices or chips. There were drawn four clarifiers of about 500 gallons each. The last two were very dilute, owing to the excess of water used in washing the chips after cells were filled. This juice was heated with lime and brought to neutrality; heater and blanket, which was quite insignificant, removed. It was then settled and clear juice run into the double effect and concentrated.

There was a large quantity of settlings, and some scums, which were weighed and analyzed, and thrown away to avoid interfering with the well clarified syrup. The following are weights obtained:

Syrup, 1562 pounds.
Settlings and scums, 1070 pounds.
Sugar, 49 pounds.
Molasses, 752 pounds.

The following are the notes of diffusion:

Every effort was made to hold the temperature at 200 degrees Fahrenheit, but until the battery has been used in one entire round this is almost impossible to do, since sending in quickly

water heated to 200 degrees Fahrenheit into cold iron cells filled with cold chips, the loss of heat by radiation and convection is very great. Six minutes were allowed for the diffusion of each cell after the hot water was turned on. Every effort to grain in the vacuum pan proved abortive, as the following notes of Mr. Baldwin, who had charge of the pan and was assisted by Mr. Barthelemy, will show:

"Part of juice concentrated in double effect on first watch remainder on second watch, when the juice got very hot, 180 degrees, and was emptied in cars to cool; finished concentrating on morning of 13th at a temperature of 155 to 160 degrees Fahrenheit. Juice dark-colored and some feculent matter present. After mixing syrups, started vacuum strike pan at 2 P. M., on 13th; temperature, 138 to 140 degrees Fahrenheit; very thick; nothing but candy would form in the pan. Allowed to stand half an hour until candy dissolved, but no grain. Stood again one hour; at 7 P. M. still no grain. Cooked very thick and remained in pan till 2 P. M. next day, when it was all boiled to string sugar and put in the hot room. Injured some by being cooked to candy.

In the hot room it began at once to grain, until the wagon was quite solid with small grains of sugar."

It was centrifugalled and gave the following results:

Sugar, 49 pounds.
Molasses, 752 pounds.

RECAPITULATION.

Cane contained		349.75	pounds of	sucrose.
Syrup	"	273.22	"	"
Scums	"	20.33	"	"
Chips	"	56.20	"	"
Sugar	"	44.58	"	"
Molasses	"	228.61	"	"

Sugar obtained,		15.5	pounds	per ton of	sorghum.
Molasses	"	237.1	"	"	"

After the analyses of the mill juices were known, little or no hope was entertained of successful sugar results. Indeed, it is wonderful with such juices, and after such treatment, that any sugar should be obtained.

September 17th.—It has been often published that neither sorghum nor its juices will stand transportation or delay in working them up after being cut. That such is not the case with us is abundantly proven by the following and many other experiments during this season:

On September 16th, Mr. Barrow, assistant at the State Experiment Station, was sent to Baton Rouge to harvest and ship a car-load of sorghum from that station to this. By 9 o'clock on the morning of the 16th, he had cut and loaded a closed car with Early Orange sorghum. This sorghum was quite wet from dew and had its leaves and tops still on—conditions making fermentation quite feasible to almost any crop. It was delivered at Kenner by the Mississippi Valley Railroad, at 7 P. M. of the same day. It was unloaded and delivered at sugar-house at 12 o'clock M. of the 17th and worked up as delivered. This cane had been badly blown down by the storm of the August 19th, and was filled with suckers several feet long, now in full heads. It was quite low in sugar, as the following analysis of selected stalks, made on September 11th, showed:

Total solids.	Sucrose.	Glucose.
11.9	7.8	4.52

Began diffusion at 9 A. M. Filled twenty-three cells with chips and drew off thirty-one cells of juice. Finished in early evening, after two slight detentions. Cells diffused sixteen minutes each, except three times, when interrupted. The temperature varied from 150 to 200° Fahrenheit. The juice was boiled to a syrup in double effect, and made into string sugar in the vacuum pan. Boiled all night, finishing the next day. The string sugar was run into the hot-room, where it was grained into almost a solid mass. The following are the amounts used:

Weight of canes		13,266	pounds.
Less weight of tops	2,445		"
" " leaves	1,785		"
" " trash in the yard	1,558		"
" " chips not used	82—	5,867	"
Clean cane used		7,399	"

The juices from this were concentrated into syrup, giving 1491 pounds; scums thrown away, 313 pounds; juice made into molasses, 259 pounds.

Sugar obtained, 115 pounds.
Molasses obtained, 672 pounds.

Sugar, per ton of sorghum, 31.4 pounds.
Molassses, per ton of sorghum, 181.8 pounds.

RECAPITULATION.

Cane contained (calculated) . . .	435	pounds	sucrose.
Syrup made into sugar contained .	328	"	"
" " " molasses " .	57	"	"
Scums contained	7	"	"
Chips "	32	"	"

Fibre in cane, 15.5 per cent.

The following are the laboratory results:

MILL JUICES.

Variety.	Total Solids.	Sucrose.	Glucose.	Glucose to Sucrose.
Early Orange	11.4	7.0	3.33	48 per cent.
" "	11·3	7.0	3.58	51 "
" "	11.7	6.9	3.30	48 "

DIFFUSION JUICES.

Variety.	Total Solids.	Sucrose.	Glucose.	Glucose to Sucrose.
Early Orange..........	....	3.2	1.79	56 per cent.
" "	....	3.95	2.00	51 "
" "	....	3.00	1.92	64 "
" "	....	3.90	2.17	55 "
" "	....	3.90	2.32	59 "
" "	....	4.10	2.00	48 "
" "	....	3.50	1.72	49 "
" "	....	3.70	1.46	39 "
" "	....	4.10	1.73	42 "
" "	....	3.50	1.50	48 "
" "	....	3.60	1.66	46 "
" "	....	4.20	1.62	38 "
" "	....	3.90	1.70	44 "
" "	....	3.30	1.60	48 "

DIFFUSION CHIPS.

Variety.	Total Solids.	Sucrose.	Glucose.	Glucose to Sucrose.
Early Orange..........	....	.3	.14	47 per cent.
" "	....	.3	.18	60 "
" "	....	.25	.16	64 "
" "	....	.35	.149	43 "
" "	....	.25	.14	56 "
" "	....	.15	.13	90 "
" "	....	.15	.10	40 "

CLARIFIED JUICES.

Sucrose.	Glucose.	Glucose to Sucrose.
3.6	1.85	51 per cent.
3.9	1.60	41 "
3.1	1.57	51 "
1.8	.99	55 "
1.3	.56	43 "
1.1	.54	49 "

SYRUPS.

Sucrose.	Glucose.	Glucose to Sucrose.
22.	11.1	50 per cent.

SCUMS.

Sucrose.	Glucose.	Glucose to Sucrose.
4.2	2.22	53 per cent.

SUGAR.

Sucrose.	Glucose.
92.1	2.94

MOLASSES.

Sucrose.	Glucose.
34.	22.72

Here, as before, the dilution was great owing to the water used in washing the chips after the cells were filled. This cane had nearly a constant composition, and from glucose ratio there has been little or no inversion either in cells or in concentration of syrup. In fact, when water at 200° Fahrenheit is sent into cells and maintained there, for six minutes, at this temperature little or no inversion takes place, notwithstanding the weather gauge showed this day a maximum temperature of 83° Fahrenheit.

September 20th.—The following canes were selected for this run: Link's Hybrid, White India, White Mammoth, and the second planting of Early Amber. The suckers, of which there were many, were removed by hand. Filled nine cells. Everything worked well.

Weight of canes used		5,078	pounds.
Less weight of tops	812		"
" " trash	653		"
" " suckers	208		"
" " chips not used	74—	1,747	"
Clean cane used		3,331	

Juice neutralized with lime, blanket removed, settled, concentrated in double effect, and *grained* in vacuum pan; then emptied into car and run into hot-room, where it solidified into crystals of sugar of small size.

Weight of syrup, 695 pounds.
Weight of scums, etc., 150 pounds.
Weight of sugar, 40 pounds.
Weight of molasses, 235 pounds.

Sugar, per ton of sorghum, 24 pounds.
Molasses, " " 141 "

The following are the laboratory results:

MILL JUICES.

Variety.	Total Solids.	Sucrose.	Glucose.	Glucose to Sucrose.
Link's Hybrid	10.6	6.7	1.48	22 per cent.
White India...........	14.1	10.0	1.25	12½ "
White Mammoth	10.5	6.9	2.14	33 "
White Amber (Neb.)...	10.7	6.5	1.92	29 "
White Amber..........	10.4	5.4	3.12	57 "

DIFFUSION JUICES.

Total Solids.	Sucrose.	Glucose.	Glucose to Sucrose.
4.8	3.05	1.13	37 per cent.
6.0	3.50	1.51	43 "
6.0	3.70	1.51	41 "
5.2	3.20	1.57	49 "
5.6	3.25	1.61	49 "

DIFFUSION CHIPS.

Sucrose.	Glucose.
.20	.16
.30	.14
.20	.13
.10	.12
.10	.12

CLARIFIED JUICE.

Total Solids.	Sucrose.	Glucose.	Glucose to Sucrose.
5.9	3.5	1.39	39 per cent.
2.1	1.4	.51	38 "

SYRUPS.

Total Solids.	Sucrose	Glucose.	Glucose to Sucrose.
32.94	17.5	7.04	40 per cent.

SCUMS.

Sucrose.	Glucose.	Glucose to Sucrose.
1.7	·73	41 per cent.

SUGAR.

Sucrose.	Glucose.
92.3	2.93

MOLASSES.

34.	20.
Sucrose.	Glucose.

RECAPITULATION.

Sucrose in	syrup	121.62
"	scums	2.55
"	chips	16.56
"	sugar made	36.88
"	molasses made	79.90

Fibre in cane, 15.04 per cent.

The following determinations of albuminoids were made:

MILL JUICES.

Link's Hybrid	.430
Kansas Orange	.215
New Orange	.322
Early Orange	.425
Early Orange (Baton Rouge cane)	.371
Early Orange " " "	.345
Mill juices for September 30	.307

DIFFUSION JUICES.

September 12	.0531
September 17, (Baton Rouge cane)	.0748
September 20	.1270

CLARIFIED JUICES.

September 12, 1st clarifier	.0319
September 12, 2d "	.0212
September 17, Baton Rouge cane	.0357
September 20	.0348

It will thus be seen that diffusion juices contain much less albuminoids than mill juices.

LATE PLANTING OF SORGHUM.

After determining to erect a diffusion battery to work up sorghum, a late planting was made upon land from which a crop of oats had been recently harvested. The land was broken and harrowed, and sorghum planted May 23d. The continued rains during June and July prevented necessary cultivation. The storm of August 19th prostrated it, and, though far from being ripe, never recovered. Most of these seed were received from Mr. Wm. P. Clements, of Sterling Sugar-works, in Kansas, and was mainly hybrids of different varieties. They were carefully followed during maturity with chemical analyses, and at no time did any of them show a large sugar content.

On October 9th, a part of this plat was cut and diffused, but with no results in sugar. The diffusion was well done, leaving less than .15 per cent. of sucrose in the chips, but the juice was very dilute, and contained a larger quantity of glucose than sucrose. After concentration to masse cuite, it was left in the hot-room for several weeks with no indication of grain.

On November 15th, the rest of this plat, consisting of the Honduras, Chinese and Golden Rod varieties, were gathered and diffused. The yields per acre for the first two were twenty tons. The stalks were very large and tall, and could these varieties be made even moderately sweet, they would be valuable sugar plants. But their sugar content was very low, as the following analyses show:

MILL JUICES.

	Brix.	Sucrose.	Glucose.
Honduras	5.7	.80	1.17
Chinese	8.1	2.10	2.23
Golden Rod	8.1	1.60	2.59

MIXED DIFFUSION JUICES.

3.4	.60	1.25

SYRUP.

4.8		5.31

Here the process of clarifying in the cell by the use of lime was tried for the first time on sorghum. A much larger quantity of lime was used than was required for cane. Results indicated that with an abundance of lime, plenty of heat and a very fine chip a good clarification could be obtained in the cell. Further trials, however, of this process on sorghum are needed to decide fully upon its efficacy.

Since glucose was so largely in excess of sucrose, no attempt was made to obtain sugar. The syrup was concentrated into molasses and sent to the molasses tank.

CONCLUSIONS.

While the work of the present season has not been at all favorable to the manufacture of sugar from sorghum, in Louisiana, yet the application of diffusion to the extraction of juice both from sorghum and sugar cane has been clearly demonstrated. But this has been a most disastrous year for sorghum, in Louisiana. Could a fair quality of sorghum have been worked, it is believed that fully 100 to 125 pounds of sugar to the ton would have been easily obtained. In 1886, the Early Orange variety gave 13 per cent. sucrose; in 1887, 10.5 per cent., and with small glucose ratios each year. This season it gave only 7 per cent. sucrose, and with a glucose ratio of about 50. Even with this composition, 31½ pounds sugar per ton was obtained. What would have been the result had diffusion been applied to the sorghum of 1886?

However, the stations will repeat again the experiments next year, with more promise of success.

1

SUGAR CANE.

(FIELD EXPERIMENTS.)

BULLETIN NO. 20

OF THE

SUGAR EXPERIMENT STATION,

KENNER, LA.

WM. C. STUBBS, Ph. D., Director.

—ISSUED BY—

THOMPSON J. BIRD,

COMMISSIONER OF AGRICULTURE, BATON ROUGE, LA.

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SUGAR EXPERIMENT STATION,
KENNER, LA., January, 1889.

Major T. J. Bird, Commissioner of Agriculture, Baton Rouge, La.:

Dear Sir—Herewith I hand you for publishing Bulletin No. 20, covering "Field Experiments" for '88 in Sugar Cane made on this Station.

WM. C. STUBBS, Director.

FIELD EXPERIMENTS.

The experiments of the past year were mainly a continuation of the work of previous years. Several experiments involving questions heretofore satisfactorily answered have been eliminated, while new ones, with original questions have been inaugurated.

The experiments have been of four kinds, viz:

1. Germination questions.
2. Physiological questions.
3. Varieties best adapted to Louisiana.
4. Manurial reqirements.

GERMINATION QUESTIONS.

By reference to Bulletin No. 14, pages 1 *et sequentes*, the question of the "part of the stalk best for seed" is propounded and discussed, and the results given of a series of experiments to test this question. For two years these experiments have been made as "plant cane." This year it was determined to follow the plant into "stubble" and to see the results in the latter. Accordingly the experiments begun in '87, have been continued as stubble in '88. The following from Bulletin No. 14 describes them:

To determine this question, the following experiments were instituted with a view of continuing them through a series of years in order to eliminate as far as possible all the modifying factors, incident to one year's experiment. Great pains were taken to select healthy stalks of uniform length. These were cut up into short pieces beginning with tha green immature top. Two eyes were left upon each cutting and each stalk was selected so as to give eleven cuttings. Seventy-five of these cuttings containing 150 eyes were devoted to each experiment.

The land was in excellent order, having had a large crop of pea vines turned in early in the fall with a four-horse plow. The cuttings were carefully deposited in each row and covered by a hoe. The following are the experiments:

PLAT O—GERMINATION QUESTIONS.

Experiment No.	1—75	white immature joints of two eyes each.
" "	2—75	joints next to No. 1, partially white, two eyes each.
" "	3—75	" " " 2, full red " " "
" "	4—75	" " " 3, " " " "
" "	5—75	" " " 4, " " " "
" "	6—75	" " " 5, " " " "
" "	7—75	" " " 6, " " " "
" "	8—75	" " " 7, " " " "
" "	9—75	" " " 8, " " " "
" "	10—75	" " " 9, " " " "
" "	11—75	" butts, two eyes each.

These experiments were planted February 9, 1887, and occasional observations were made and the stalks upon each row carefully counted until suckering began. At the harvest in '87, the stalks on each row were counted and weighed—the juice extracted and carefully analyzed.

The stubble in spring of '88 was offbarred, dug with stubble digger and the dirt returned. The subsequent cultivation was with cultivator and plow. No manure was used either year. Below are given tables of results for both years.

Table No. 1 contains the number of stalks up at each observation, the number harvested with weights, the average weight of each stalk, the yield and number of stalks per acre for '87. Table No. 2 gives the chemical analyses of the juices, with "purity coefficient," "glucose ratios" and available sugar per ton for 1887. Table Nos. 3 and 4 are the same for 1888.

TABLE 1.

PLAT O—GERMINATION QUESTIONS.

Planting different parts of the Stalks of cane, February 9th, 1887.

Part of the stalk planted.	Number of stalks from 150 eyes planted, counted.									Tons per acre.	No. of stalks per acre.
	Feb. 27.	M'ch 10.	M'ch 13.	M'ch 17.	M'ch 19.	M'ch 25.	At harvest, Nov. 3.	Weight of stalks.	Average weight of each.		
1 Upper white joints	5	24	24	24	26	34	97	247 lbs.	2.54 lbs.	18.14	14.287
2 Next to " "	12	39	41	41	45	45	140	407 "	2.91 "	32.06	21.050
3 " " No 2	10	45	48	54	63	69	165	485 "	2.94 "	38.18	25.987
4 " " " 3	4	27	34	39	45	51	152	428 "	2.82 "	33.75	23.940
5 " " " 4	1	27	36	45	51	53	154	442 "	2.87 "	34.80	24.255
6 " " " 5	1	25	35	43	52	58	149	426 "	2.86 "	33.56	23.467
7 " " " 6	0	19	20	25	33	40	147	400 "	2.72 "	31.48	23.152
8 " " " 7	0	13	18	23	27	32	133	320 "	2.41 "	25.24	20.947
9 " " " 8	1	19	23	28	34	39	130	340 "	2.61 "	26.82	20.552
10 " " " 9	0	12	14	20	26	36	97	214 "	2.21 "	16.88	15.276
11 Butts*............	0	11	15	20	41	41	73	160 "	2.19 "	12.62	11.520

* This row was seriously injured in the Summer by proximity to a fig tree.

TABLE 2.

PLAT O—FIELD AND SUGAR HOUSE RESULTS, Nov. 3.

Number and kind of Experiments.	Yield per acre, in tons.	ANALYSES.				Purity co-efficient.	Glucose ratio.	Lbs. available sugar upon 70 p. c. extraction.	
		Degree Baume.	Total solids.	Sucrose.	Glucose.			Per ton.	Per acre.
1 Upper white joints	18.14	7.4	13.31	10.3	1.24	77.38	12.04	118	2141
2 Next to " "	32.06	7.8	14.01	11.2	1.35	79.94	12.05	128	4104
3 " " No. 2....	38.18	7.6	13.71	10.3	1.28	75.12	12.42	117	4467
4 " " " 3....	33.75	7.3	13.21	10.0	1.60	75.70	16.	99	3341
5 " " " 4....	34.80	7.5	13.61	10.0	1.60	73.47	16.	99	3445
6 " " " 5....	33.56	7.8	14.01	10.9	1.35	77.80	12.38	124	4161
7 " " " 6....	31.48	7.3	13.11	10.5	1.28	75.63	12.19	120	3777
8 " " " 7....	25.24	7.8	14.01	10.6	1.35	81.36	12.73	120	3029
9 " " " 8....	26.82	8.	14.41	10.5	1.35	72.86	12.85	119	3192
10 " " " 9....	16.88	7.9	14.31	11.5	1.35	81.36	11.73	133	2245
11 Butts*............	12.62	8.4	15.01	12.0	1.21	79.94	10.08	143	1805

*Injured by shade.

TABLE 3.

PLAT O—FIELD RESULTS—STUBBLE CANE—Nov. 14, 1888.

Part of the stalk planted.	No. of stalks harvested.	Weight of stalks.	Average weight of each.	Tons per acre.	No. of stalks per acre.
1 Upper white joints	76	136 lbs.	1.79 lbs.	10.71	11970
2 Next to " "	119	206 "	1.73 "	16.22	17742
3 " No. 2	133	257 "	1.89 "	19.72	20947
4 " No. 3	127	226 "	1.70 "	17.79	20002
5 " No. 4	130	244 "	1.88 "	19.21	20475
6 " No. 5	142	238 "	1.68 "	18.74	22305
7 " No. 6	124	220 "	1.77 "	17.32	19536
8 " No. 7	132	256 "	1.94 "	20.16	20790
9 " No. 8	104	192 "	1.84 "	15.12	16380
10 " No. 9	89	146 "	1.64 "	11.49	14017
11 Butts*	53	75 "	1.42 "	......	8347

*A fig tree near this row injured yield.

TABLE 4.

PLAT O—FIELD AND SUGAR HOUSE RESULTS (STUBBLE), NOV. 14, 1888.

Number and kind of Experiment.	Yield per acre in tons.	ANALYSES.				Purity Co-efficient.	Glucose Ratio.	lbs. available sugar upon 70 per ct. extract	
		Degree Baume.	Total solids.	Sucrose.	Glucose.			Per ton.	Per acre.
1 Upper white joints	10.71	8.4	15.2	13.5	.89	88.81	6.59	170.10	1821.77
2 Next to " "	16.22	8.2	14.8	13.3	.75	89.86	5.63	169.75	2753.34
3 " " No. 2	19.72	8.4	15.1	13.5	.77	89.40	5.70	172.27	3397.16
4 " " " 3	17.79	8.4	15.2	13.7	.80	90.13	5.84	175.00	3113.25
5 " " " 4	19.21	8.3	14.9	13.5	.82	90.60	6.07	171.78	3299.89
6 " " " 5	18.74	8.6	15.5	14.0	.69	90.32	4.92	181.51	3401.49
7 " " " 6	17.32	8.3	15.0	13.0	.82	86.66	6.30	164.78	2853.98
8 " " " 7	20.16	8.1	14.6	12.7	.87	86.98	6.85	159.53	3216.12
9 " " " 8	15.12	7.5	13.6	11.4	.89	83.82	7.80	140.91	2130.56
10 " " " 9	11.49	7.8	14.1	12.3	.91	87.23	7.39	153.09	1759.00
11* " " " 10	.....	8.8	15.8	13.9	.98	87.97	7.05	174.02	....

*Injured by shade.

CONCLUSIONS.

In 1887, the following facts were noted:

1. The upper joints germinated much more rapidly than the lower ones.

2. That many sprouts from the green, white, immature top died during an extended drouth in March and April.

3. That the upper matured joints were fully the equal if not the superior to the lower joints, for seed.

In 1888, barring the whole joints, the upper part of the cane gave slightly better results in stand, in tonnage, and in sugar, confirming the results of the previous years. It is therefore again asserted, that could a practical way be established for utilizing as seed the upper thirds of all the cane, and grinding the remainder, an immense gain would yearly accrue to our industry. Cannot some generous planter devise a way for the economical solution of this question?

HOW MANY STALKS OF CANE TO PLANT?—WHICH IS THE BEST FOR SEED, PLANT OR STUBBLE CANE?

These questions, begun in experimental form, in 1887, with plant cane, have been followed into "stubble."

The following, taken from Bulletin No. 14, pages 6 *et seq.*, fully describe the experiments of the first year, with results:

What number of stalks of cane shall we plant to secure the best results?

This question is variously answered in practice; one to four stalks. If we plant in seven-foot rows (the usual width) and use cane five feet long, weighing two and one half pounds each, there will be required to plant an acre, one stalk and a good lap, about two tons of cane; two and a lap, four tons; three and a lap, six tons; and four and a lap, eight tons. Cane was worth in Louisiana, during the past season, from $3 to $5 per ton. If, therefore, it can be shown that one stalk and a lap, or even two and a

lap, furnish an abundance of seed, it is a serious loss of money to plant three and four.

Whether it is best to use plant or stubble cane for seed was combined with the above, so as to make the experiments answer both questions simultaneously. Accordingly a plat of ground one acre deep was laid off for the experiments, and divided perpendicular to its depths into two equal parts: The front was planted with first-year stubble, and the rear with plant cane, thus duplicating each one of the questions with both kinds of seed.

In the same plat were also tried a few experiments confirmatory of those already described, viz.: What part of the cane is best for seed? Good canes were selected and cut: First—into two equal parts, the tops planted in one experiment, and the butts in the next; and, second—into three equal parts, the tops given to one experiment, the middles to another, and the butts to a third.

There being ground enough left in this plat for another experiment, the following was tried, duplicated alike with plant and stubble seed: Unslaked lime, at the rate of three tons per acre, was spread evenly over the top of the row, after the cane was planted and covered, to see if the heat generated by the natural slaking of the lime would not induce early germination, and ultimately to test the value of large applications of lime to our soils.

The following are the experiments in full:

No. 1. One cane with a lap, cut in the row.
No. 2. Two canes with a lap, cut in the row.
No. 3. Three canes with a lap, cut in the row.
No. 4. Four canes with a lap, cut in the row.
No. 5. One cane, no lap, uncut.
No. 6. Upper halves of canes, two and a lap.
No. 7. Lower halves of canes, two and a lap.
No. 8. Upper thirds of canes, two and a lap.
No. 9. Middle thirds of canes, two and a lap.
No. 10. Lower thirds of canes, two and a lap.
No. 11. Unslaked lime, three tons per acre.

These experiments were planted February 10, and the young plants carefully counted twice before suckering began. At harvest, each experiment was weighed, stalks counted, juice separately extracted and carefully analyzed. Table 5 and 6 give the results for 1887 and No. 7 for 1888.

TABLE 5.

PLAT O—GERMINATION QUESTIONS, GATHERED NOVEMBER 4, 1887.

Number and kind of Experiments.	March 13		May 25.		November 4.					
	No. of Sprouts.		No. of Sprouts.		Plant.			Stubble.		
	Plant.	Stubble	Plant.	Stubble	No. of Stalks.	Weight of Stalks, lbs.	Tons per acre.	No. of Stalks.	Weight of Stalks, lbs.	Tons per acre.
1. 1 cane (cut)........	36	50	89	77	371	1114	33.42	420	1109	33.27
2. 2 " "	87	83	172	154	409	1232	36.96	413	1338	40.14
3. 3 " "	136	144	220	214	430	1144	34.32	440	1336	40.08
4. 4 " "	120	158	250	279	409	1296	38.88	479	1410	42.30
5. 1 " uncut........	30	48	53	77	357	1146	34.33	413	1432	33.96
6. Upper halves	108	106	148	154	421	1360	40.80	436	1292	38.76
7. Lower halves	53	57	123	109	388	1334	40.02	402	980	29.40*
8. Upper thirds	139	101	168	147	420	1278	38.34	344	918	27.54*
9. Middle thirds	100	109	165	180	385	1276	38.28	310	860	25.80*
10. Lower thirds	117	46	177	104	407	1134	34.02	296	740	22.20*
11. Unslaked lime	114	103	165	155	396	1184	35.52	273	605	18.15*

*Injured more or less by shade of a live oak tree.

TABLE 6.

PLAT O—GERMINATION—QUESTIONS CONTINUED.

Number and kind of Experiments.	Yield per acre in tons	ANALYSES. Degree Banme.	Total Solids.	Sucrose.	Glucose.	Co efficient Purity.	Glucose Ratio.	lbs. available sugar upon 70 p. c. extract Per ton.	Per acre.
1 1 Cane cut, plant	33.42	7.05	12.71	9.9	1.77	77.89	17.86	101.5	3392.
1 " " stubble	33.27	7.3	13.24	11.3	1.57	85.35	13.88	125.30	4169.
2 " " plant	36.96	7.4	13.39	10.2	1.84	76.17	18.03	104.16	3850.
2 " " stubble	40.14	7.4	13.49	10.2	2.24	76.61	21.96	95.76	3844.
3 " " plant	34.32	7.3	13.19	10.1	1.92	76.57	19.00	101.08	3469.
3 " " stubble	40.08	7.5	13.69	10.3	1.90	75.23	18.44	104.20	4180.
4 " " plant	38.88	7.5	13.59	9.9	2.04	73.58	20.60	95.76	3723.
4 " " stubble	42.30	7.5	13.59	10.9	1.90	80.20	17.43	112.70	4767.
5 1 "uncut plant	34.33	7.3	13.24	10.8	1.90	81.57	17.59	111.30	3821.
5 1 " " stubble	33.96	7.4	13.49	10.4	2.00	77.83	19.23	103.60	3418.
6 Up'r halves plant	40.80	7.3	13.24	10.8	1.90	81.57	17.59	111.30	4541.
6 " " stubble	38.76	7.5	13.69	10.2	2.00	74.50	19.60	100.80	3907.
7 Lower " plant	40.02	7.3	13.19	10.8	2.14	81.88	19.51	106.26	4253.
7 " " stubble	29.40*	7.4	13.49	10.3	2.00	76.64	19.41	102.20	2004.
8 Up'r Thirds plant	38.34	7.3	13.14	10.4	1.90	79.90	18.26	105.70	4053.
8 " " stubble	27.54*	7.6	13 89	10.6	2.00	77.03	18.86	106.40	2930.
9 Middle " plant	38.28	7.4	13.44	10.5	1.90	78.12	18.09	107.10	4100.
9 " " stubble	25.80*	7.6	13.89	10.5	2.00	75.59	19.04	105.00	2709.
10 Lower " plant	34.02	7.6	12.74	10.0	1.86	78.49	18.60	101.00	3436.
10 " " stubble	22.20*	7.9	14.29	11.2	1.82	78.37	16.25	118.58	2521.
11 un'kd lime plant	35.52	8.4	15.24	12.4	1.40	81.36	11.29	134.20	5122.
11 " " stubble	18.15	8.3	15.09	12.9	1.74	85.42	13.48	144.06	2615.

*Injured by proximity of live oak.

The cane used in the above experiments was excellent, and the subsequent seasons were all that could be desired. The results secured may not be obtainable every season. However, these experiments strongly point to the conclusion that with good cane in well prepared soil and with good seasons, two canes and a lap furnish an abundance of seed, and the largest profits. This will be more plainly seen by deducting from the tonnage made, the tonnage required to plant as follows:

	Plant.			Stubble.		
	Tonnage made per Acre.	Tonnage planted.	Net Tonnage per Acre.	Tonnage made per Acre.	Tonnage planted.	Net Tonnage per Acre.
1 stalk..	33.42	2.00	31.42	33.27	2.00	31.27
2 stalk..	36.96	4.00	32.96	40.14	4.00	36.14
3 stalk..	34.32	6.00	28.32	40.08	6.00	34.08
4 stalk..	38.88	8.00	32.88	42.30	8.00	32.30

TABLE 7.

PLAT O—FIELD RESULTS—STUBBLE CANE—Nov. 14, 1888.

Number and kind of Experiment.	No. of stalks harvested.	Weight of stalks.	Average weight of each.	Tons per acre.	No. of talks per acre	Remarks.
No. 1. 1 cane cut, plant ..	315	516 lbs	1.64 lbs	15.48	18900	
" 1. 1 " " stubble	356	668	1.89	20.04	21360	
" 2. 2 " " plant..	355	578	1.63	17.34	21300	
" 2. 2 " " stubble	419	770	1.86	23.10	25140	
" 3. 3 " " plant..	377	544	1.44	16.32	22620	
" 3. 3 " " stubble	433	719	1.68	21.57	25980	
" 4. 4 " " plant..	433	691	1.62	20.73	25980	
" 4. 4 " " stubble	461	866	1.88	25.98	27660	
" 5. 1 " uncut plant .	358	742	2.07	22.26	21480	
" 5. 1 " " stubble	338	622	1.84	18.66	20280	
" 6. Upper halves plant	398	870	2.19	26.10	23880	
" 6. " " stubble	374	784	2.09	23.52	22440	
" 7. Lower " plant..	400	804	2.01	24.12	24000	
" 7. " " stubble	209	521	2.50	15.63	12540	Injured by shade.
" 8. Upper thirds plant	405	826	2.04	24.78	24300	
" 8. " " stubble	310	492	1.59	14.76	18600	Injured by shade.
" 9. Middle " plant..	414	750	1.81	22.50	24840	
" 9. " " stubble	298	454	1.52	13.62	17680	Injured by shade.
" 10. Lower " plant..	373	604	1.62	18.12	22380	
" 10. " " stubble	277	432	1.56	12.96	16620	Injured by shade.
" 11. Lime plant	394	678	1.72	20.34	23640	
" 11. Lime stubble	238	352	1.50	10.56	14280	Injured by shade.

Through an accident in the laboratory, the sample of juices were mixed, which vitiated the accuracy of results, hence no table is given for 1888 corresponding to Table No. 6 for 1887.

In 1887, two stalks and a lap gave the largest net yields, both with cane from plant and stubble. It was also shown that, contrary to expectation, the "stubble" seed gave slightly superior result, both in tonnage and sugar content. In 1887, the

uncut cane proved the equal for seed with that cut in the usual way.

In 1888, it is difficult to draw a conclusiion as to the number of stalks to plant in order to secure a maximum stubble crop. It confirms the result heretofore obtained, that the original sprouts and the suckers produce stubble equally as well. This is shown by the fact that Experiment No. 4, where last year 60 per cent. of the harvested cane was original sprouts, both with plant and stubble for seed, gave this year larger results than No. 1, where the sprouts constituted less than 25 per cent. It is not, then, the "suckers only which give the stubble of next year."

Here, also, is shown again that the upper part of the cane is as good (and perhaps better) as any other portion, for seed.

The stubble from stubble seed shows a slight superiority to that from plant seed.

PHYSIOLOGICAL EXPERIMENTS.

The question of the influence of suckers upon cane has been *decidedly* answered in favor of the suckers. The plat upon which no suckers were permitted to grow in 1886 has given, both in 1887 and 1888, a good stand and fair yields of first and second year stubble. The experiments mentioned on page —–, show that the original sprouts and suckers produce stubble equally well. All of these experiments corroborate those previously made, and show conclusively:

1. That suckering, or tillering, is a necessary and healthy condition of the sugar cane.

2. Taat stubble comes both from the original sprouts and from suckers.

WHAT DISTANCE APART SHALL WE GIVE OUR CANE ROWS?

To test this question, a plat of ground was selected that had been two years in oats, followed each year by peas broadcast. The ground was broken and carefully laid off in experiments of three rows each:

Experiment 1, three rows 3 feet wide.
Experiment 2, three rows 4 feet wide.
Experiment 3, three rows 5 feet wide.
Experiment 4, three rows 6 feet wide.
Experiment 5, three rows 7 feet wide.
Experiment 6, three rows 8 feet wide.

These rows were two acres long, and were divided into equal parts. Upon the upper part, plant was used for seed; and on the lower, stubble. Each of these parts was again equally divided, and upon the southern half of each part manure was used. the same amount to each experiment. This gave each row the same amount of manure, but very varying quantities per acre. Bradley's Fertilizer was used on the part planted with stubble, and Bowdker's Fertilizer on that with plant. These goods were especially prepared in Boston, for Mr. Frank Ames, for his sugar plantation, and by him presented to the Station.

The previous culture of this plat (thirteen) was 1885, in cane; 1886–'87, in fall oats, followed by "solid peas," which were removed for hay. The ground was broken with four-horse plows in September, dlrectly after the pea-vines were removed. It was harrowed, rows laid off, and cane planted in the open furrows (two stalks and a lap), October 24th; covered with plow, and land-bedded out, and the middles and drains opened. All except one row in the six-foot plat germinated early in the spring, and gave a good stand. This row happened to fall about an old open water-furrow, previously used to divide the plats of oats and to drain the soil. It was several inches lower than the other rows, and the cane did not appear until some weeks after the stand was secured elsewhere. This row never caught up with the rest, and its effects are plainly shown in all of the results of the six-foot row experiments. It also clearly illustrates the value of thorough drainage and the disadvantage of spots depressed even a few inches.

On May 10th, the manures were applied after the cane had been off-barred. This was distributed by hand, throwing the fertilizer from the open furrow on one side across the row to the open furrow on the other side. The soil was then returned to

the cane and the middles split out. Up to this time the cultivation had been uniform and easy, but subseduently the three and four foot experiments received no cultivation. Two attempts were made, after the cane had reached several feet in height, to cultivate these rows with a two-horse plow, by driving the mules "tandem," but a failure was made each time. The soil was too stiff. The other experiments were cultivated, like the rest of the cane on the Station, in the usual way.

The difficulty of cultivation must always remain as a serious objection to narrow rows for cane in stiff soils. In light soils a one-horse plow may do all the work efiectually. However, in these experiments our narrow rows do not show any loss from lack of cultivation, nor from the absence of high ridges and deep middles, though the subsequent seasons were extremely unfavorable.

A diagram of plat No. 13, with yield, sucrose, glucose and available sugar per acre, is here presented. Also the results of experiments with manures, and yields and analyses:

DIAGRAM.

PLAT 13—DIFFERENT DISTANCES IN THE ROW. 3 ROWS EACH.

FRONT.

	3 ft. rows.	4 ft. rows.	5 ft. rows.	6 ft. rows.	7 ft. rows.	8 ft. rows.		
Yield per Acre, tons	31.37	23.53	20.82	16.22	17.10	19.75	No Manure.	Plant Cane for Seed.
Analysis								
Sucrose	13.00	11.9	12.00	12.70	12.30	12.90		
Glucose	1.01	.96	.83	s92	.86	.40		
Available sugar per Acre, lbs.	5046.18	3545.78	3136.32	2570.54	2635.79	2190.57		
Yield per Acre, tons	35.91	31.44	27.71	21.29	21.91	18.40	Bowker's.	
Analysis								
Sucrose	11.20	12.20	11.20	11.90	9.50	12.50		
Glucose	.86	1 07	.86	1 06	.87	:96		
Available sugar per Acre, lbs.	4982.15	4665.70	3845.87	3023.	2515.27	2849.06		
Yield per Acre, tons	34.41	25.93	24.91	21.69	24.89	20.65	No Manure.	Stubble for Seed.
Analysis: Sucrose 11 20 Glucose .75								
Available sugar per Acre, lbs.	4432.58	3659.24	3575.30	3060.99	3576.48	2914.13		
Yield per Acre, tons	39.38	38.55	34.04	30.87	29.69	21.59	Bradley's.	
Analysis								
Sucrose	14.10	12.50	13.40	12.80	12.70	12.40		
G ucose	.78	1.15	.97	1.15	1.08	.97		
Available sugar per Acre, lbs.	7128.57	6748.56	5694.89	4788.55	4605.57	3177.91		

REAR.

RESULTS OF PLAT 13—DIFFERENT WIDTHS OF ROWS IN PLANT CANE.

Widths of rows, feet.	Fertilizer used.	Amount Fertilizer per acre.	Yield per acre in tons.	ANALYSES. Degree Baume	Total solids.	Sucrose.	Glucose.	Purity co-efficient.	Glucose Ratio.	Lbs. available sugar upon 70 per ct. extraction. Per ton.	Per acre.
3	Bradley ...	1336 lbs	39.38	9.	16.2	14.1	.78	87.03	5.33	181.02	7128.57
4	"	1002	38.55	8.4	15.1	12.5	1.15	82.78	9.12	150.90	6748.25
5	"	800	34.04	8.8	15.8	13.4	.97	84.81	7.23	167.30	5694.89
6	"	668	30.87	8.5	15.3	12.-	1.15	83.66	8.98	155.12	4788.55
7	"	573	29.69	8.4	15.2	12.7	1.08	83.55	8.50	155.12	4605.51
8	"	504	21.59	8.2	14.8	12.4	.97	83.78	7.82	153.30	3177.91
3	No manure		31.41	7.3	13.2	11.2	.75	84 09	6.75	141.12	4432.58
4	"		25.93	7.3	13.2	11.2	.75	84.09	6.75	141.12	3659.24
5	"		24.91	7.3	13.2	11 2	.75	84.09	6.75	141.12	3515.30
6	"		21.69	7.3	13.2	11.2	.75	84.09	6.75	141.12	3060.91
7	"		24.69	7.3	13.2	11.2	.75	84.09	6.75	141.12	3516.48
8	"		20.65	7.3	13.2	11.2	.75	84.09	6.75	141.12	2914.13
3	Bowdker's.	1336	35.91	7.5	13.5	11.2	.86	82.96	7.67	138.79	4982.15
4	"	1002	31.44	7.8	14.0	12.2	1.07	87.14	8.77	148.40	4665.70
5	"	800	27.72	7.4	13.4	11.2	.80	83.58	7.67	138.74	3845.87
6	"	667	21.29	7.9	14.2	11.9	1.06	83.80	8.90	144.34	3023.00
7	"	573	21.91	6.7	12.0	9.5	.87	79.16	9.15	114.80	2515.27
8	"	504	18.40	7.8	14.	12.5	.96	89.28	7.68	154.84	2849.06
3	No manure		31.37	8.0	14.4	13.	1.01	90.27	7.76	160.86	5040.18
4	"		23.53	7.5	13.6	11.9	.96	87.50	8.06	146.44	3545.73
5	"		20.82	7.9	14.2	12.0	.83	84 50	6.91	150.64	3130.32
6	"		16.22	8.2	14.8	12.7	·92	85.81	7.32	158.48	2570.54
7	"		17.10	8.0	14.4	12.3	.86	85.41	6.99	154.14	2635.79
8	"		19.75	8.4	15.1	12.9	.90	85.43	6.97	161.70	3190.57

COMPARISON OF RESULTS OF PLAT 13.

	3-FOOT ROWS		4-FOOT ROWS		5-FOOT ROWS		6-FOOT ROWS		7-FOOT ROWS		8-FOOT ROWS	
	Tons.	Available sugar.	Tons.	Available sugar.	Tons.	Available sugar.	Tons.	Available sugar.	Tons.	Available sugar.	Tons.	Available sugar.
Bradley's	39.38	7128.37	38.55	6748.25	34.04	5694.89	30.87	4788.55	29.69	4605.51	21.59	3177.91
No manure	31.41	4432.58	25.93	3659.34	24.91	3575.30	21.69	3060.99	24 89	3576.48	20.65	2214.13
Bowdker's.....	35.91	4982.15	31.44	4665.70	27.72	3845.87	21.29	3033.00	21.91	2515.27	18.40	2849.06
No manure	31 37	5046.18	23.53	3545.73	20.82	3136.32	16.22	2570.54	17.10	2635.79	19.75	3190.57
Average.......	34.52	5402.37	29.86	4654.73	26.87	4048.09	22.52	3380.77	23.39	3318.26	20.12	3032.92
Excess of 3-foot rows over ...	.....	....	4.66	747.64	7.65	1354.28	12.00	2021.60	11.13	2084.11	14.40	2369.45
Excess of 4-foot rows over ...	.....	....	.....	....	2.99	606.64	7.34	1273.96	6.47	1336.47	9.74	1621.81
Excess of 5-foot rows over ...	.....	....	.....	....	.....	....	4.35	667.32	3.48	729.83	6.75	1015.17
Excess of 6 foot sows over ...	.....	....	.....	....	.....	....	.....	....	.....	62.51	2.40	347.85
Excess of 7-foot rows over ...	.....	....	.....	....	.....	....	.....	....	.....	....	3.27	285.34

The sugar content in these experiments seems to depend upon factors other than widths of rows, though the average of the three-foot rows experiments show (slightly) the highest amount of sucrose and lowest of glucose.

This was expected on account of imperfect cultivation and closeness of rows. The following table gives the average sucrose and glucose of each group of experiments:

TABLE SHOWING AVERAGE SUCROSE AND GLUCOSE OF EACH GROUP PLAT 13.

	Sucrose.	Glucose.	Group
Average of 3-foot rows	12.76	.88	1
" 4- " "	12.20	1.06	2
" 5- " "	12.20	.89	3
" 6- " "	12.80	1.04	4
" 7- " "	11.50	·90	5
" 8- " "	12.60	.94	6

In the above experiments the cane planted with "stubble" had, for two years, reeeived an application of cotton-seed meal, phosphate and kainite on oats, while that planted with "plant" had received only phosphate and kainite. This accounts in part at least for the increased yields of the Bradley fertilizer and its "no manure" over the Bowdker and its "no manure."

To plant an acre in cane, with rows 7 feet apart, using "two stalks and a lap" for seed, will require about 4 tons of cane; at the same rate there will be required for seed:

In 3-foot	rows,		$9\frac{1}{3}$	tons	per	acre.
" 4	"	"	7	"	"	"
" 5	"	"	5.6	"	"	"
" 6	"	"	$4\frac{2}{3}$	"	"	"
" 7	"	"	4	"	"	"
" 8	"	"	$3\frac{1}{2}$	"	"	"

Subtracting these quantities from average yield above will give net cane per acre over the amount used in planting as follows:

3-foot	rows,		25.19	tons.
4	"	"	22.86	"
5	"	"	21-27	"
6	"	"	17-86	"
7	"	"	19.39	"
8	"	"	16-62	"

CONCLUSIONS.

It is unwise as well as unscientific to draw conclusions from a single year's experience, yet the above results strongly suggest thought and reflection. Have we not in our efforts at easy and thorough cultivation passed tne boundary of maximum yield of sugar content in the width of our rows? Do not wide rows and late cultivation also tend to large immature canes at harvest? The frequent remarks of planters that "cane never grows well until laid by," and "cane never grows fast until it shades the ground," cause the inquiring mind to ask the reasons for these popular axioms. May not the frequent rupture of the roots in cultivation, which wide rows permit to be extended (perhaps) beyond the requirements of the plane, and the growth of grass and weeds, which flourish longer (because unshaded) in wide rows (the killing of which often requires the late cultivation), have much to do with originating these popular beliefs? It is certainly desirable in this climate to have early maturing cane. To do this obstacles or checks upon its growth must be presented in some form in order that it may do the only thing

fect it—i. e., mature. These obstacles may be found in want of drainage or lack of fertility. The last obstacle may be presented by withholding fertilizers, absence of deep plowing, want of rain and crowding the land with cane, etc. May not a width of row[3] just sufficient for good cultivation, varying according to soil, be better than the conventional 7-foot row now almost everywhere found. The station will continue to test this question.

VARIETIES OF CANE.

Since the inauguration of this Station, over seventy specimens of foreign canes have been received from the United States consuls, in various parts of the world. These were sent to us through the courteous requests of Hon. Norman J. Colman, now Secretary of Agriculture, and Hon. Thomas F. Bayard, Secretary of State, at Washington. Of these there are now growing on the Station forty-eight varieties. Each of these has been carefully examined and analyzed, and the material obtained has been found so voluminous and important that it is deemed best to embody same in a separate bulletin upon "Varieties of Cane," which will be issued in the near future.

MANURIAL RESULTS.

One of the chief aims of this Station is to find a fertilizer that will produce a maximum tonnage with a maximum sugar-content upon the soils of Louisiana. The soils upon this Station are classified as "mixed" and "black," and from the analyses given in Bulletin No. 14 are found deficient rather in physical qualities than in chemical ingredients. The former limits the available supply of the latter, and renders large applications of manures necessary for the production of large crops.

What kinds of manures, and in what forms and quantities, has been the object of the experiments which follow. It should be remembered that any physical or mechanical amendment to a soil, such as "underdraining," "deep plowing," "sub-soiling," etc., is in itself a manure, since it enables the roots of a plant to forage over an increased area, and thus obtain larger supplies of available food.

The Station had seven plats devoted to manurial requirements, three of which may be designated as strictly scientific, and the rest as popular. The three scientific plats were devoted: (1), to nitrogenous manures; (2), to phosphoric acid manures; (3), to potassic manures.

The object of these plats are:

1. To tell the requirements of these soils for each ingredient.
2. To tell the form best adapted to cane.
3. To tell the quantity most profitable for cane.

Accordingly, all the available forms of these ingredients have been used in varying quantities. To test the requirements of a soil for any particular ingredient, every other ingredient must be present in excess. Hence each particular ingredient tested has been combined with an excess of other ingredients. The first ground was—

PLAT VIII—POTASSIC MANURES.

SECOND YEAR STUBBLE CANE—HARVESTED OCTOBER 14-17.

This plat was designed to test primarily the requirements of this soil for potash, and then to determine the form and quantity best adapted to cane. There has been used the muriate, sulphate, nitrate, carbonate and kainite, and such quantities of each have been taken as to represent 60, 120 and 180 lbs. of pure potash per acre, or 1-3, 2-3 and 3-3 rations. These are excessive quantities, but they are used with the hope of determining whether potash in any form or quantity effected the tonnage or sugar content of cane. It was offbarred and dug April 16th. Manures applied and middles split out April 18th. Subsequent cultivation with a disc cultivator. It was laid by with a 4-horse plow. A diagram of the plat, together with the results ot the experiments, are hereunto attached.

DIAGRAM—PLAT VIII.

POTASSIC MANURES.

	Meal Phosphate.	Meal Phosphate & 1/3 Ration.	No Manure	Meal Phosphate & 2/3 Ration.	Meal Phosphate & 3-3 Ration.	
No. of Experiment......	6	7	8	9	10	
Yield per acre in tons....	11.45	15.26	9.24	18.02	15.33	Muriate Potash Group.
Sucrose................	12.2	12.3	12.2	13.6	12.6	
Glucose................	1.85	1.59	1.72	1.47	1.44	
lbs. available sugar 70 per cent extraction per acre						
No. of Experiment;......	11	12	13	14	15	
Yield per acre in tons ...	11.13	13.72	7.84	15.72	7.14	Kainite Group.
Sucroee................	12.7	....	11.5	12.1	11.6	
Glucose................	1.49	... .	1.66	1.41	1.55	
lbs available sugar 20 per cent extraction per acre						
No. of Experiment.......	16	17	18	19	20	
Yield per acre in tons ...	9.03	12.11	7.38	15.38	13.54	Sulphate Potash Group
Sucrose................	12 20	12.80	12.00	12.90	12.60	
Glucose................	1.89	1.84	1.89	1.84	1 83	
lbs. availabie sugar 20 per cent extraction per acre						
No. of Experiment.......	21	22	23	24	25	
Yield per acre in tons....	8.05	10.29	6.23	9.84	6.58	Carbonate Potash Group.
Sucrose................	12 50	12.70	11.60	11.60	11.10	
Glucose................	1.82	1.91	2 04	1.58	1.55	
lbs. available sugar 70 per cent extraction per acre						
No. of Experiment	26	27	28	29	30	
Yield per acre in tons....	7.14	8.54	4.69	13.96	14.38	Nitrate Potash Group
Sucrose................	11.40	11.50	11.40	11.00	10.90	
Glucose................	1.82	1 40	1.41	1.42	1.43	
lbs. available sugar 70 per cent extraction per acre						

TABLE 16.

RESULTS OF PLAT VIII — POTASSIC MANURES.

No. of Expe'm't.	MANURES USED.	Yield per acre, in tons.	ANALYSES. Total solids.	ANALYSES. Sucrose.	ANALYSES. Glucose.	Purity coeffic't.	Glucose ratio.	Pounds of available sugar upon 70 per cent extraction. Per ton.	Pounds of available sugar upon 70 per cent extraction. Per acre.	When harvest'd.	REMARKS.
6	Meal Phosphate	11.45	14.9	12.2	1.85	81.88	15.16	132	1511	October 13	
7	Meal Phosphate, 120 lbs. Muriate Potash,	15.26	14.9	12.3	1.59	82.55	12.92	137	2096	October 13	Manure Potash.
8	No Manure	9.24	14.9	12.2	1.72	81.88	14.09	135	1244	October 13	
9	Meal Phosphate, 240 lbs. Muriate Potash,	18.02	15.	12.6	1.47	84.	11.66	145	2622	October 13	Group No. 1.
10	Meal Phosphate, 360 lbs. Muriate Potash,	15.33	14.4	12.6	1.44	87.50	11.42	145	2240	October 13	
11	Meal Phosphate	11.13	14.8	12.7	1.49	85.81	11.73	146	1630	October 13	
12	Meal Phosphate, 480 lbs. Kainite,	13.72	....	....	....	......	......	....	....	October 13	Kainite.
13	No Manure	7.84	14.1	11.5	1.66	81.56	14.43	126	1068	October 13	
14	Meal Phosphate, 960 lbs. Kainite,	15.72	14.	12.	1.41	85.71	11.75	137	2174	October 13	Group No. 2.
15	Meal Phosphate, 1440 lbs. Kainite,	*7.14	14.4	11.6	1.55	80.55	13.36	129	921	October 13	
16	Meal Phosphate	9.03	14.9	12.2	1.89	81.82	15.49	131	1183	October 15	
17	Meal Phosphate, 120 lbs. Sulphate Potash,	12.11	15.3	12.8	1.84	83.66	14.38	140	1702	October 15	Sulphate Potash.
18	No Manure	7.38	14.8	12.	1.89	81.08	15.75	128	946	October 15	
19	Meal Phosphate, 240 lbs. Sulphate Potash,	15.38	15.4	12.9	1.84	83.76	14.26	142	2183	October 15	Group No. 3.
20	Meal Phosphate, 360 lbs. Sulphate Potash,	13.54	15.2	12.6	1.83	82.89	14.52	138	1856	October 15	

21	Meal Phosphate	8.05	15.2	12.5	1.82	82.23	14.55	136	1162	October 15	Carbonate Potash. Group No. 4.
22	Meal Phosphate, 82½ lbs. Carbonate Potash	10.29	15.4	12.7	1.91	82.46	15.04	137	1416	October 15	
23	No Manure	6.23	14.3	11.6	2.04	81.11	17.58	119	745	October 15	
24	Meal Phosphate, 165 lbs. Carbonate Potash,	9.84	13.9	11.6	1.5-	83.45	13.62	129	1271	October 15	
25	Meal Phosphate, 247¼ lbs. Carbonate Potash,	*6.58	13.4	11.1	1.55	82.83	13.96	122	807	October 15	
26	Meal Phosphate	7.14	13.8	11.4	1.82	82.59	15.96	121	867	October 15	Nitrate Potash. Group No. 5.
27	Meal Phosphate, 135 lbs. Nitrate Potash,	8.54	13.7	11.5	1.40	83.94	12.17	132	1123	October 13	
28	No Manure	4.69	12.9	11.4	1.41	88.37	12.36	129	610	October 15	
29	Meal Phosphate, 270 lbs. Nitrate Potash,	13.96	13.6	11.	1.42	80.89	12.91	124	1733	October 15	
30	Meal Phosphate, 405 lbs. Nitrate Potash.	14.38	13.4	10.9	1.43	81.34	13.11	122	1653	October 15	

* Stands poor.

By comparing each group first with "no manure, and then with its meal phosphate, we get the increased gains due to potash.

No. of Group.		Tons.	Lbs. available sugar.
1	Increase Meal Phosphate over "no manure"............	2.21	267
1	" ⅓ Muriate Potash over Meal Phosphate.........	3.91	585
1	" ⅔ " " " " "	6.57	1111
1	" 3-3 " " " " "	3.88	729
2	" Meal Phosphate over "no manure".............	3.29	562
2	" ⅓ Kainite over Meal Phosphate..................	2.59	......
2	" ⅔ " " " "	4.59	545
2	" 3-3 " " " "	......	......
3	" Meal Phosphate over "no manure".............	1.65	237
3	" ⅓ Sulphate Potash over Meal Phosphate.........	3.08	510
3	" ⅔ " " " " "	6.33	1000
3	" 3-3 " " " " "	4.52	673
4	" Meal Phosphate over "no manure".............	1.82	417
4	" ⅓ Carbonate Potash over Meal Phosphate........	2.24	254
4	" ⅔ " " " " "	1.82	109
4	" 3-3 " " " " "	......	......
5	" Meal Phosphate over "no manure".............	2.45	257
5	" ⅓ Nitrate Potash over Meal Phosphate	1.40	256
5	" ⅔ " " " " "	6.78	866
5	" 3-3 " " " " "	7.24	786
	Average increase of Nitrate Potash over Meal Phosphate.	5.14	636
	" " Muriate " " " "	4.78	808
	" " Sulphate " " " "	4.48	730
	" " Kainite " " " "	1.46	......
	" " Carbonate " " " "	.86	......

This plat, planted in cane in spring of '86 and cultivated as stubble cane since, has received each year the same application of manures, upon the same experiments. For three years they have received excessive quantities of potash in the forms given above, and the results published each year. The carbonate of potash has not produced the results expected. Indeed, both the pure carbonate of potash and the ashes of cotton hulls have appeared to exercise detriment rather than profit to cane. The other forms of potash used in excessive quantities have given increased yields, due doubtless to the indirect action of these salts upon the soil. The question of profit is not here included, since the cost of several mixtures above given are far in excess of the value of the increased products.

PHOSPHORIC ACID MANURES.

PLAT VII—SECOND YEAR STUBBLE.

The object of this plat is to test the form and quantity of phosphoric acid best adapted to cane; using it in a soluble form in dissolved bone black and acid phosphate, in a precipitated form as precipitated bone black and precipitated acid phosphate, and in an insoluble form as bone dust and finely ground Charleston phosphate, called "floats"; also in the natural form of Orchilla guano. Each used in 1-3, 2-3 and 3-3 rations. This plat was harvested in '87 during a very wet spell, and was accordingly badly cut up by the carts. An experiment was tried of rectifying this evil at once by the following treatment. As soon after harvest as the soil would permit, the dirt was taken from the stubble with 4-horse plow and a stubble digger run over it. The earth was then re-turned with 4-horse plow, and by aid of Le Dow Disk cultivator it was thrown up well around the cane. The middles were then split out, quarter drains opened, and the plat remained undisturbed until spring, when it was off-barred, manured and treated like the other plats. This fall working was not productive of the good expected. This was the last piece of stubble on the place to germinate, and the stand was nowhere excellent. Whether the injury done by hauling over it wet, or the subsequent fall plowing or both, did the injury, was not apparent. On account of defective stand only two groups of this plat were worked into sugar, the rest being windrowed for seed to be used in spring planting.

TABLE 17.

PARTIAL RESULTS—PLAT VII—PHOSPHORIC ACID MANURES.

No. of Exp't	Manures Used.	Yield per Acre in Tons	Analyses.			Purity Co-efficient.	Glucose Ratio	lbs. available sugar 70 p. c. extraction.		When Harvested.	Remarks.
			Total Solids.	Sucrose.	Glucose.			Per ton	Per acr.		
1	Basal Mixture	5.6	13.8	11.5	1.58	83.33	13.75	128	718	Oct. 19.	
2	Basal Mixture 180 lbs. Dissolved Bone Black	11.13	14.6	12.	1.53	82.19	12.52	136	1571		
3	No manure	9.10	13.7	11.2	1.82	81.75	16.25	118	1183		
4	Basal Mixture 360 lbs. Dissolved Bone Black	14.91	14.6	12.3	1.50	84.24	12.19	141	2098		
5	Basal Mixture 540 lbs. Dissolved Bone Black	17.18	14.3	12.1	1.51	84.61	12.48	138	2369		
6	Basal Mixture	8.43	14.2	11.9	1.49	83.80	12.52	135	1139		
7	Basal Mixture 180 lbs. Acid Phosphate	13.44	14.3	12.2	1.39	85.31	11.39	141	1898		
8	No manure	7.45	13.4	10.8	1.71	80.59	15.83	116	860		
9	Basal Mixture 360 lbs. Acid Phosphate	12.04	12.5	10.6	1.24	84.80	11.69	123	1475		
10	Basal Mixture 540 lbs. Acid Phosphate	15.85	14.2	11.6	1.41	81.69	12.15	133	2108		

The stand was better where phosphates were used, but was everywhere so irregular as to preclude accurate conclusions from results. It, however, confirms previous deductions that phosphates, in an available form, are needed by these soils.

PLAT II—SECOND YEAR STUBBLE.

The object of these experiments was to test the efficacy of certain popular manures, together with the quantities most desirable for largest results. Varying quantities of cotton seed, cotton seed meal and tankage have been used alone and in connection with acid phosphate, floats, kainite, ashes, cotton hulls, etc. It was off-barred and manures applied April 14th. The subsequent treatment like the plats described.

TABLE.

RESULTS OF PLAT II—SECOND YEAR STUBBLE.

No. of Exp't.	Manures Used Per Acre.	Yield per Acre in Tons.	ANALYSES. Total Solids.	Sucrose.	Glucose.	Purity Co-efficient.	Glucose Ratio.	Lbs. available sugar, 70 per cent extraction. Per ton.	Per acre.	When Harvested.
1	200 lbs. Cotton Seed Meal 100 lbs. Acid Phosphate	8.30	14.1	11.6	1.40	82.27	12.06	133	1104	
2	333 lbs. Cotton Meal 167 lbs. Acid Phosphate	10.30	14.1	11.5	1.40	81.55	12.17	132	1355	
3	140 lbs. Sulphate Ammonia 120 lbs. Dried Blood 200 lbs. Cotton Meal 460 lbs. Acid Phosphate 80 lbs. Muriate Potash	17.84	14.7	12.	1.53	81.63	12.75	136	2423	
4	466 lbs. Cotton Meal 234 lbs. Acid Phosphate	14.44	14.7	12.	1.53	81.63	12.75	136	1961	
5	600 lbs. Cotton Meal 200 lbs. Acid Phosphate	16.72	....	......	....	......	......	......	......	
6	600 lbs. Cotton Meal 300 lbs. Acid Phosphate 300 lbs. Kainite	14.84	....	......	....	......	......	...	......	
7	600 lbs. Cotton Meal	11.16	14.8	12.6	1.12	85.13	8.88	153	1703	
8	260 lbs. Sulphate Ammonia 460 lbs. Acid Phosphate 80 lbs. Muriate Potash	14.16	15.	12.8	1.20	85.33	9.38	154	2181	
9	300 lbs. Acid Phosphate 300 lbs. Kainite	6.81	14.1	11.7	1.12	82.96	9.57	140	953	
10	300 lbs. Kainite	7.12	14.7	12.5	1.06	85.03	8.48	153	1086	
11	200 lbs. Cotton Meal 100 lbs Floats	6.56	14.3	12.3	1.18	86.01	9.59	148	969	

12	333 lbs. Cotton Meal 167 lbs. Floats	7.88	....	......	....	......	......	......	......
13	No Manure	4.72	13.7	11.7	1.21	85.40	10.34	139	655
14	466 lbs. Cotton Meal 234 lbs. Floats	8.76	....	......	....	......	......	......	......
15	600 lbs. Cotton Meal 300 lbs. Floats	13.44	....	......	....	......	......	......	......
16	600 lbs. Cotton Meal 300 lbs. Floats 300 lbs. Kainite	12.97	16.3	14.1	.85	86.50	6.02	179	2324
17	600 lbs. Cotton Meal 300 lbs. Floats 300 lbs. Kainite 200 lbs. Gypsum	9.72	16.3	14.1	.82	86.50	5.81	180	1749
18	No Manure	5.44	15.4	12.7	1.09	82.46	8.58	155	841
19	600 lbs. Cotton Meal 300 lbs Floats 300 lbs. Cotton Hull Ashes	13.08	16.2	14.	1.12	86.42	8.	158	2071
20	300 lbs. Tankage	10.08	14.8	12.8	1.11	86.49	8.67	156	1574
21	450 lbs. Tankage	9.34	13.4	12.	.76	89.55	6.33	152	1544
22	700 lbs. Tankage	9.52	13.6	12.2	.84	89.70	6.88	153	1460
23	No Manure	5.39	14.3	12.4	1.01	86.71	8.14	153	822
24	900 lbs. Tankage	8.90	....	......	....	......	......	......	......
25	900 lbs. Tankage 300 lbs. Kainite	13.04	15.4	13.9	.61	90.26	4.39	182	2373
26	900 lbs. Tankage 300 lbs. Kainite 200 lbs. Gypsum	13.48	16.8	14.9	.79	88.69	5.32	192	2586
27	900 lbs. Tankage 300 lbs. Cotton Hull Ashes	11.12	16.5	14.7	.87	89.09	5.91	188	2086
28	No Manure	6.48	16.1	14.25	.94	88.50	6.59	180	1166
29	1700 lbs. Cotton Seed (Raw)	10.48	16.	14.2	1.10	88.75	7.74	176	1841
30	1700 lbs. Cotton Seed (Raw) 300 lbs. Acid Phosphate	11.72	....	......	....	......	......	......	......
31	1700 lbs. Cotton Seed (Raw) 300 lbs. Acid Phosphate 300 lbs. Kainite	11.28	....	......	....	......	......	......	......

TABLE—*Continued.*

No. of Exp't.	Manures Used Per Acre.	Yield per Acre in Tons.	ANALYSES. Total Solids.	Sucrose.	Lucrose.	Purity Co-efficient.	Glucose Ratio.	Lbs. available sugar, 70 per cent extraction. Per ton.	Per acre.	When Harvested.
32	1700 lbs. Cotton Seed (Raw) 300 lbs. Cotton Hull Ashes	12.00	14.5	12.4	1.10	85.53	8.84	150	1806	
33	No Manure	7.34	15.5	13.2	1.04	85.16	7.87	163	1197	
34	1700 lbs. Cotton Seed (Raw) 300 lbs. Floats	10.48	15.7	14.3	.99	91.08	6.95	179	1878	
35	1700 lbs. Cotton Seed (Raw) 300 lbs Floats 200 lbs. Gypsum	14.08	15.8	13.8	.93	87.34	6.74	174	2444	

The inspection of above table will show that many of the popular manures are exceedingly valuable; that the different forms of nitrogen in cotton seed, cotton seed meal, tankage and sulphate ammonia, and dried blood, are about equally efficacious as sources of nitrogen, and that large tonnage is not always productive of largest sugar yields, and, therefore, manuring should be done judiciously both as to quantity and quality.

TILED VERSUS UNTILED LAND.

PLATS IV. AND V.—FIRST YEAR STUBBLE.

These plats of equal area lie side by side and with no apparent difference, save V. is tiled and IV. untiled. They were planted in cane on March 3, 1887 and have since received the same treatment.

The following are the manures used on each plat:

Experiment No.	1—	500 lbs Cotton Seed Meal. 500 lbs Acid Phosphate. 500 lbs Kainite.
"	2—	500 lbs Cotton Seed Meal. 500 lbs Acid Phosphate.
"	3—	Nothing.
"	4—	500 lbs Cotton Seed Meal. 500 lbs Orchilla Phosphate. 500 lbs Kainite.
"	5—	500 lbs Cotton Seed Meal. 500 lbs Orchilla Phosphate.
"	6—	Nothing.
"	7—	500 lbs Cotton Seed Meal. 500 lbs Bone Dust. 500 lbs Kainite.
"	8—	500 lbs Cotton Seeh Meal. 500 lbs Bone Dust.
"	9—	Nothing.
"	10—	500 lbs Cotton Seed Meal. 500 lbs Floats. 500 lbs Kainite.
"	11—	500 lbs Cotton Seed Meal. 500 lbs Floats.
"	12—	Nothing.
"	13—	500 lbs Cotton Seed Meal. 500 lbs Ashes Cotton Hulls. 500 lbs Kainite.
"	14—	500 lbs Cotton Seed Meal. 500 lbs Ashes Cotton Hulls.
"	15—	Nothing.
"	16—	500 lbs Cotton Seed Meal.
"	17—	500 lbs Acid Phosphate.
"	18—	500 lbs Kainite.
"	19—	Nothing.

TABLE—RESULTS PLAT IV. AND V. UNTILED AND TILED LAND—FIRST YEAR STUBBLE.

No. of Exp't	Condition of Plat.	Tons per acre.	ANALYSES. Total Solids.	Sucrose.	Glucose.	Purity Coefficient	Glucose Ratio.	lbs available sugar upon 70 p. c. extraction. Per ton.	Per acre	When harvested.
1	Untiled	14.49	16.1	14.7	.65	91.30	4.42	193	2797	Nov. 5.
	Tiled	22.49	16.1	13.6	1.10	84.47	8.09	167	3756	
2	Untiled	20.44	16.1	13.7	1.07	85.09	7.81	169	3454	
	Tiled	25.99	....	....	....	.....	....	...	....	
3	Nothing	9.75	....	....	....	.....	....	...	....	
4	Untiled	17.68	15.4	13.4	.91	87.01	6.79	169	2988	
	Tiled	22.37	15.4	13.6	.67	88.31	4.92	177	3959	
5	Untiled	16.89	16.3	14.6	.81	89.57	5.54	187	3158	Nov. 8.
	Tiled	23.52	15.7	13.7	.77	87.26	5.62	177	4163	
6	Nothing	10.43	15.4	13.9	.79	90.25	5.67	181	1888	
7	Untiled	16.45	15.5	13.9	.66	89.67	4.74	180	2961	
	Tiled	21.93	15.5	13.9	.77	39.67	5.53	179	3925	
8	Untiled	18.87	15.7	14.	.78	89.17	5.57	179	3378	
	Tiled	20.04	....	....	....	.....	....	...	....	
9	Nothing	10.43	13.8	12.6	.62	91.30	4.92	163	1700	Nov. 10.
10	Untiled	13.48	14.7	13.3	.69	90.47	5.18	172	2318	
	Tiled	16.66	15.7	13.6	.63	86.62	4.63	177	2949	
11	Untiled	12.36	15.8	13.7	.98	86.71	4.96	178	2200	
	Tiled	21.18	15.1	13.3	.53	88.08	3.98	175	3707	
12	Nothing	9.10	14.9	13.1	.59	87.92	4.50	171	1556	
13	Untiled	9.45	16.	14.6	.53	91.25	3.63	193	1824	
	Tiled	16.45	16.4	14.8	.58	92.50	3.98	195	3208	
14	Untiled	12.36	15.8	14.4	.47	91.13	3.26	192	2372	
	Tiled	17.61	16.8	15.3	.55	91.07	....	...	3575	
15	Nothing	8.45	....	....	....	.....	4.59	145	....	
16	Untiled	9.80	13.8	12.3	.60	89.13	4.87	160	1568	
	Tiled	11.70	14.8	13.2	.61	89.18	4.62	172	2012	
17	Untiled	9 20	14.7	12.8	.54	87.07	4.21	168	1546	
	Tiled	12.99	15.8	14.3	.52	90.50	3.53	189	2455	
18	Untiled	6.58	16.	14.4	.57	90.	3.05	190	1250	
	Tiled	7.79	16.3	14.6	.53	89.57	3.61	166	1293	
19	Nothing	7.88	16.2	14.4	.54	88.88	3.75	190	1402	

DIAGRAM—PLAT IV AND V.—STUBBLE CANE.

	UNTILED. Kainite.	UNTILED.	No Manure.	TILED. Kainite.	TILED.	
No. of Experiment......	1	2	3	1	2	
Yield per acre, tons.....	14.49	20.44	9.75	22.49	25.99	Cotton Meal.
Sucroser................	14.70	13.70	....	13.60	.....	Acid Phosphate.
Glucose.................	.65	1.07	....	1.10	.....	
Pounds available sugar..	27.97	34 54	....	37.56	.....	
No. of Experiment......	4	5	6	4	5	
Yield per acre, tons......	16.89	17.68	10.43	23.52	22.37	Cotton Meal.
Sucrose.................	14.60	13.40	13.90	13.70	13.50	Orchilla.
Glucose.................	.81	.91	.79	.77	.67	
Pounds available sugar..	31.58	29.88	18.88	41.63	39.59	
No. of Experiment......	7	8	9	7	8	
Yield per acre, tons....	16.45	18.87	10.45	21.93	20.04	Cotton Meal.
Sucrose.................	13.90	14.00	12.60	13.90	.....	Bone Meal.
Glucose.................	.66	.78	.62	.77	.....	
Pounds available sugar..	29.61	33.78	17.00	39.25	.....	
No of Experiment......	10	11	12	10	11	
Yield per acre, tons....	12.36	13.48	9.10	21.18	16.61	Cotton Meal.
Sucrose.................	13.71	13.30	13.10	13.30	13.60	Floats.
Glucose.................	.68	.69	.59	.53	.63	
Pounds available sugar..	22.00	23.18	15.56	37.07	29.49	
No. of Experiment......	13	14	15	13	14	
Yield per acre, tons....	9.45	12.36	8.45	16.45	17.61	Cotton Meal.
Sucrose.................	14.60	14.40	.....	14.80	15.30	Cotton Hull Ashes,
Glucose.................	.53	.47	.....	.58	.55	
Pounds available sugar..	18.24	23.72	.....	32.08	35.75	
No. of Experiment......	16	17	18	16	17	
Yield per acre, tons....	9.80	9.20	7.88	11.70	12.99	
Sucrose.................	12.30	12.80	14.40	13.20	14.30	
Glucose.................	.60	.54	.54	6.10	.52	
Pounds available sngar..	15.68	15.46	14.02	20.12	24.55	
No. of Experiment......	19	19	20	19	19	
Yield per acre, tons......	7.79	7.79	5.88	6.58	6.58	
Sucrose.................	14.4	14.4	.....	14.60	14.60	
Glucose.................	.57	.57	.....	.53	.53	
Pounds available sugar..	12.50	12.50	.....	12.93	12.93	
			No Manure.			

No. 16 is Cotton Seed Meal, alone.
No. 17 is Acid Phosphate, alone.
No. 19 is Kainite, alone.

DEDUCTIONS FROM ABOVE.

There are two sets of experiments both in the tiled and untiled plats. Calling them first and second we shall have in

Set. 1.	Tons.	lbs. available sugar.
Increase Experiment 1 tiled over untiled	8.00	959
" " 4 " " "	6.63	1005
" " 7 " " "	5.48	964
" " 10 " " "	8.82	507
" " 13 " " "	7.00	1384
" " 16 " " "	3.79	444
" " 19 " " "	2.73	43
Total	42.45	5206

Set 2.	Tons.	lbs. available sugar.
Increase Experiment 2 tiled over untiled	5.55	——
" " 5 " " "	4.69	971
" " 8 " " "	1.17	——
" " 11 " " "	3.13	631
" " 14 " " "	5.25	1203
" " 17 " " "	——	909
" " 19 " " "	.42	43
Total	20.21	2757
Less	1.47	
	18.74	

Increase of 14 Experiments, tiled over untiled	61.19 and 12 Experiments	8063
Average increase per acre	4.38	672
" " first set	6.06	758
" " second set	2.68	551

Here the average increase of all the tiled over untiled is at the rate of 4.37 tons per acre.

Taking first set of untiled, that furthest from the tiled, and we have an increase of 6.06 tons, 758 lbs. the available sugar, which more nearly represents the true difference between tiled and untiled land since the second set runs within a few feet of the tiled land and the beneficial effects of the tiles are perfectly apparent, both in the working of the land and the increase of crops. On this piece the difference between it and its fellow tiled, is only 2.68 tons and 557 lbs. available suger.

A review of the actual results of tile draining is herewith given, which contains figures and facts more convincing than logic:

REVIEW OF RESULTS OF TILED-DRAINED LANDS.

Plant Cane in 1887.

	Tons.	Pounds available sugar.
Yield of first set of tiled plats, per acre	23.87	3819
Yield of first set of untiled plats, per acre	17.64	2839
Difference	6.23	980
Yield of second set of tiled plats, per acre	22.02	3328
Yield of second set of untiled plats, per acre	19.45	2972
Difference	2.58	357
Average yield of tiled plats, per acre	22.94	3574
Average yield of untiled plats, per acre	18.54	2905
Difference	4.40	669

Increased yield of first set, in tonnage	35.3	per cent.
Increased yield of first set, in sugar	34.5	per cent.
Increased yield of second set, in tonnage	13.2	per cent.
Increased yield of second set in sugar	12.	per cent.
Increased yield average, in tonnage	24.2	per cent.
Increased yield average, in sugar	23.	per cent.

Stubble Cane in 1888.

	Tons.	Pounds available sugar.
Yield of first set of tiled plats, per acre	18.03	3152
Yield of first set of untiled plats, per acre	11.97	2257
Difference	6.06	895
Yield of second set of tiled plats, per acre	17.24	2846*
Yield of second set of untiled plats, per acre	14.56	2472
Difference	2.68	374
Average yield of tiled plats, per acre	17.64	2999
Average yield of untiled plats, per acre	13.27	2362
Difference	4.37	637

Increased yield of first set, in tonnage	50.6	per cent.
Increased yield of first set, in sugar	40.	per cent.
Increased yield of second set, in tonnage	18.4	per cent.
Increased yield of second set, in sugar	15.	per cent.
Average yield of field, in tonnage	34.5	per cent.
Average yield of field, in sugar	27.5	per cent.

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* Results are too low, owing to loss of data in Experiments Nos. 2 and 8.

The actual benefits just enumerated are sufficient recommendations for tile drains; but to them must be added that lands tiled-drained are made warm, sweet and mellow. roots penetrate easier and deeper, and thus provide themselves with better apparatus for procuring water in times of drouth. In wet weather the excess is drained off, instead of being evaporated. Evaporation is a cooling process requiring much of the heat of the soil. Again, it takes a much larger quantity of heat to warm up a soil filled with water than a dry one. Water is also a poor conductor of heat, and, therefore, wet soils are warmed downward very slowly. As the water drains from a soil the air enters it and aids in warming. Snow melts at least a week earlier on an average upon drained, than on undrained land similarly situated. Vegetation advances far more rapidly on drained land. Stiff soils are made open and porous, easier worked and earlier handled after rains. The time and labor saved in a few years will pay for the tiles. The open ditches are objectionable for many reasons, some of which are constant cost of cleaning, waste of land, plowing can only be done one way; the loss of the cream of the soil by being constantly washed in small particles through the quarter drains into the ditches, and thence into the canal and swamps.

Drainage is of the first importance to the sugar planter, since cane revels in well drained land. The successful sugar planter recognizes the necessity of drainage and a heap of it. Last year there fell on this station 75 inches of rain. Each inch represents 27,154 gallons of water per acre, or in round numbers 2,536,550 gallons, or 8485 tons by weight per acre for the year. This would give an average of 25 tons of water to be evaporated daily from each acre of land did none run off the surface. If it run off what a powerful eroding and carrying power on our soils. If, as our engineers say, that 1 lb. of coal will evaporate 8 lbs. water, it would require over 3 tons of coal per day for each acre of land throughout the year to evaporate the water which falls on it. This enormous rainfall forces the necessity or drainage. But which is best, surface drains with loss of soil, or under drains, which not only relieve the soil of excess of moisture, but makes it warm and mellow. Tile drainage, like "diffusion," is surely but slowly coming.

PLAT XV—First Year Stubble Cane.

In the spring of 1886 this plat was sown broadcast in cow peas. A luxuriant growth of vines was obtained. In September the plat was divided into two equal parts. The pea vines on the west side were removed, cured into hay, and fed to the stock. The entire plat was then turned over with a 4-horse plow. There was thus presented a basis for an experiment with and without pea vines, to test the value of first, the roots alone, and second, the roots and vines. A portion of this plat was planted with plant and the rest with stubble cane. It was also divided into 5 groups of 4 experiments each.

First and second groups next to the river were fertilized at the time of planting, the fourth and fifth groups furthest from the river, in the spring, and the third or middle group was not fertilized at all. Each group had thus two experiments with pea vines turned under, and two with vines removed. The manures were duplicated on both. In group 1, cotton seed meal, acid phosphate and kainite were used as manure. In experiment 1, the meal and phosphate were combined in proportion of 2 to 1. In experiment 2, in equal quantities. The kainite was constant in both.

Group 2 was manured like group 1, except the kainite was omitted.

Group 2 was unmanured.

In group 4, experiment 1, the nitrogen was supplied in form of nitrate soda, sulphate ammonia and cotton seed meal. Of the whole amount of nitrogen supplied $\frac{3}{8}$ was in form of nitrate soda, $\frac{3}{8}$ in sulphate of ammonia, and 2-8 in cotton seed meal. This was combined with acid phosphate and kainite.

Experiment 2 of same group, had all its nitrogen in form of nitrate of soda, which was also combined with acid phosphate.

In group 5, experiment 1, dried blood and sulphate of ammonia supplied the nitrogen, while sulphate of ammonia alone was used in experiment 2. Both had also acid phosphate and kainite.

The results of this plat with above treatment in plant cane, were given in Bulletin No. 14. This year it has been cultivated in stubble cane and received all of its manures at the same time, on April 16th.

The following diagram will serve to locate the plat and this table will give the results:

DIAGRAM—PLAT XV—Stubble Cane.

	Pea vines turned under		Pea vines removed.			
No. of Experiment	1	2	1	2	Plant cane used for seed.	Group 1.
Yield per acre, tons	19.71	24.17	23.14	22.23		
Sucrose	† 12.70	.....	11.60	12.50		
Glucose	.53	.....	.73	.60		
Pounds available sugar per acre	3304	.....	3401	3610		
No of Experiment	3	4	3 *	4 *		Group 2.
Yield psr acre, tons	20.55	24.61	21.42	21.58		
Sucrose	† 13.10	12.80	12.20	14.30		
Glucose	.46	.76	.65	.53		
Pounds available sugar per acre	3567	4014	3373	4079		
No. of Experiment	5	6	5	6		Group 3. No manure.
Yield per acre, tons	14.09	18.62	15.86	14.93		
Sucrose	† 14.5	14.70	13.80	11.90		
Glucose	.48	.50	.61	.60		
Pounds available sugar per acre	2722	3636	2[illegible]64	2424		
No. of Experiment	7	8	7	8	Plant cane used for seed.	Group 4.
Yield per acre, tons	† 21.44	24.61	26.18	23.05		
Sucrose	12.60	.....	.....	.....		
Glucose	.84	.....	.....	.....		
Pounds available sugar per acre	3617	.....	.....	.....		
No. of Experiment	9	10	9	10		Group 5.
Yield per acre, tons	† 18.76	26.69	27.20	26.08		
Sucrose	.....	11.50	12.80	12.70		
Glucose	.....	.86	1.57	1.54		
Pounds available sugar per acre	.....	3181	3979	3816		

*Slightly injured by proximity of pecan tree.

†This stand on this row defective. See reason elsewhere.

RESULTS PLAT XV.—STUBBLE CANE.

No. of Exp't.	Manures Used Per Acre.	Disposition of Pea Vines.	Yield per Acre in Tons.	Analyses. Total Solids.	Analyses. Sucrose.	Analyses. Glucose.	Purity Co-efficient.	Glucose Ratio.	Lbs. available sugar upon 70 per cent extraction. per ton	Lbs. available sugar upon 70 per cent extraction. per acre	When Harvested.	Remarks.
1	500 lbs. Cotton Seed Meal 250 lbs. Acid Phosphate 100 lbs. Kainite	Turned in	19.71	14.	12.7	.53	90.71	4.17	167	3304	Nov. 26	
1	Ditto	Removed	23.14	13.2	11.6	.73	87.87	6.29	147	3401	"	
2	500 lbs. Cotton Seed Meal 500 lbs. Acid Phosphate 100 lbs. Kainite	Turned in	24.17	12.3	....	....	......	......	......	......	....	....
2	Ditto	Removed	22.23	14.1	12.5	.60	88.65	4.80	162	3610	"	
3	500 lbs. Cotton Seed Meal 250 lbs. Acid Phosphate	Turned in	20.55	14.3	13.1	.46	91.60	3.51	174	3567	"	
3	Ditto	Removed	21.42	13.6	12.2	.65	89.70	5.32	157	3373	"	
4	500 lbs. Cotton Seed Meal 500 lbs. Acid Phosphate	Turned in	24.61	14.3	12.8	.76	89.51	5.95	163	4014	"	
4	Ditto	Removed	21.58	16.	14.3	.53	89.37	3.70	189	4079	"	
5	No Manure	Turned in	14.09	16.3	14.5	.48	88.95	3.31	193	2722	"	
5	No Manure	Removed	15.85	15.6	13.8	.61	88.46	4.42	181	2864	"	
6	No Manure	Turned in	18.62	16.3	14.7	.50	90.18	3.40	195	3636	" 20	
6	No Manure	Removed	14.93	14.8	12.9	.60	85.71	4.65	168	2424	"	
7	100 lbs. Nitrate Soda 70 lbs. Sulphate Ammonia 150 lbs. Cotton Seed Meal 300 lbs. Acid Phosphate 100 lbs. Kainite	Turned in	21.44	14.7	12.6	.84	85.71	4.66	159	2716	"	
7	Ditto	Removed	26.18	....	....	....	......	......	......	.....	"	Lost
8	300 lbs. Nitrate Soda 300 lbs Acid Phosphate 100 lbs. Kainite	Turned in	24.61	....	....	....	......	......	......	.....	"	"

8	Ditto	Removed	22.05	....	....	....	......	......	......	......	"	Lost
9	100 ℔s. Sulphate Ammonia 200 ℔s. Dried Blood 300 ℔bs. Acid Phosphate 100 ℔s. Kainite	Turned in	18.76	....	....	....	......	......	......	......	"	"
9	Ditto	Removed	27.20	15.9	12.8	1.57	80.50	12.26	146	3979	"	
10	200 ℔s. Sulphate Ammonia 300 ℔s. Acid Phosphate 100 ℔-. Kainite	Turned in	26.69	13.6	11.5	.86	84.56	7.47	143	3811	"	
10	Ditto	Removed	26.08	15.9	12.7	1.54	79.87	12.12	146	3816	"	

There were two modifying factors in the above results which are worthy of notice before discussing this subject. Experiments 3 and 4 of pea vines removed were slightly influenced by proximity of a large pecan tree. The injury, however, this year, on account of excessive moisture, being far less than last year and really scarcely perceptible to the eye. The outside row of "pea vines buried under" was last year cut early in October for seed, while the rest of the plat was not harvested till late in November. From this, or some other cause, the stand on this row was defective, giving low results to every experiment it permeated. The rest of the plat was a most excellent stand. Therefore, in summing results, due consideration must be given to this fact.

Using Group 3, where no manure was used, it was found that the increase of cane due to pea vines buried under was 1.62 tons. This year, with stubble cane, it was upon the same basis of reckoning not quite 1 ton; but if we eliminate experiment 5 of the pea vines buried under, and use only the other experiments, we shall find the increase over 3 tons per acre, which more nearly represents the true increase due to the vines buried under in '86.

In fully comprehending the import of above experiments, it is necessary to know the quantity of each valuable ingredient used in each experiment. The following table gives the quantities of each, together with yields and increase over unmanured plats.

	Pounds of Nitrogen per acre.	Pounds of Phosphoric acid per acre	Pounds of Potash per acre.	Average tons per acre.	Average available sugar per acre.	Excess over average. No manure. Tons per acre.
Experiment No. 1	35	50	22	21.42	......	6.05
" " 2	35	85	22	23.20	......	7.83
" " 3	35	50	..	21.00	......	5.63
" " 4	35	85	..	23.10	......	7.73
" " 7	40	42	12	23.81	......	8.44
" " 8	45	42	12	23.33	......	7.96
" " 9	40	42	12	22.98	......	7.61
" " 10	42	42	12	26.38	......	11.01

An inspection of above will show that Potash in small quantities is without effect upon these soils. This is decidedly posi-

tive when it is remembered that two of the experiments without kainite were slightly injured by proximity to a large tree, and yet the average results of experiments without and with Kainite are about the same. See also Plats II., IV. and V.

It is also shown that excessive quantities of Phosphoric Acid have not been decidedly beneficial, and that an approach to equal parts of Nitrogen and Phosphoric Acid is perhaps the best mixture for stubbie cane on these lands. Upon this plat has been used incidentally various forms of nitrogen alone and combined. Those formulas in which Sulphate of Ammonia was used to furnish wholly or partly the Nitrogen have given signally the best results. These results are due partly to the slight excess of Nitrogen in these formulas and perhaps to the slightly better adaptability of this salt for furnishing Nitrogen to cane over other forms—a fact often noticeable in our experiments here. But while this salt shows slightly superior advantages as a manure for cane these are more than counterbalanced by the high prices which this article commands—making it almost prohibitory to the average planter.

PLAT NO. 14—SPRING PLANT CANE.

This plat was in cane in '85 and '86 and corn and peas in '77. The peas were removed for hay. The ground was broken in the fall of '87 with 4-horse plow. It was planted in the spring. This plat was divided into three parts.

PART I

was devoted to nitrogenous manures. Former experiments having demonstrated that what was known as a full ration of nitrogen, 72 pounds per acre, was injurious to cane—it was discarded in these trials. Only the one-third ration, 24 pounds per acre, and the two-thirds ration, 48 pounds per acre, were used. Cotton Seed Meal, Fish Scrap, Dried Blood, Sulphate of Ammonia and Nitrate of Soda were used to furnish the Nitrogen and such quantities of each were taken as to furnish respectively 24 and 48 pounds Nitrogen per acre. These were combined with 500 pounds Acid Phosphate and 80 pounds Muriate Potash, containing 70 pounds Soluble Phosphoric Acid and 40 pounds Potash. This mixture is called Basal Mixture, and was used alone in combination with all the forms and quantities of Nitrogen. The following are the manures used with results:

RESULTS OF PART XIV—NITROGENOUS MANURES—PLANT CANE.

No. of Exp't.	Names and Quantities of Fertilizers Used.	Yield per acre, in tons.	ANALYSES. Total solids.	Sucrose.	Glucose.	Purity co-efficient.	Glucose ratio.	Lbs. available sugar upon 70 p. c. extraction. Per ton.	Per acre.	When Harvested.
1	350 pounds of Cotton Meal, 500 " Acid Phosphte, 70 " Muriate Potash, } Basal Mixture	26.83	15.7	13.2	.83	84.07	6.29	167	4492	....
2	700 pounds of Cotton Meal and Basal Mixture	26.25	15.4	13.	.89	84.41	6.88	163	4289	....
3	350 " Fish Scrap and Basal Mixture	25.55	....	....	....	.....	.....	.....	.....	....
4	Basal Mixture	19.07	14.6	12.2	.70	83.56	5.73	156	2977	....
5	700 pounds Fish Scrap and Basal Mixture	25.20	15.	12.9	.75	86.	5.81	165	4156	....
6	180 " Dried Blood and Basal Mixture	21.81	....	....	....	.....	.....	.....	.....	....
7	360 " " " " " "	22.75	15.3	13.2	.81	86.27	6.13	168	3822	....
8	120 " Sul. Ammonia " "	23.80	15.2	13.1	.79	86.18	6.03	167	3975	....
9	240 " " " " "	23.56	15.5	13.4	.80	86.45	5.97	171	4029	....
10	No manure	17.87	14.6	12.6	.65	86.30	5.15	163	2913	....
11	150 pounds Nitrate Soda and Basal Mixture	20.55	14.6	12.9	.62	88.36	4.80	166	3411	....
12	300 " " " " " "	24.85	13.5	11.6	.72	85.92	6.20	147	3653	....

DIAGRAM.

PART I. PLAT XIV.—PLANT CANE.

1	Mixed Minerals, ⅓ Cotton Meal.	Yield per acre Sucrose Glucose Lbs. available sugar	26.83 13.20 .83 4492
2	Mixed Minerals, ⅔ Cotton Meal.	Yield per acre Sucrose Glucose Lbs. available sugar	26.25 13.00 .89 4289
3	Mixed Minerals, ⅓ Fish Scrap.	Yield per acre Sucrose Glucose Available sugar	25.55 —— —— ——
4	Mixed Minerals.	Yield per acre Sucrose Glucose Lbs. available sugar	19.07 12.20 .70 2979
5	Mixed Minerals, ⅔ Fish Scrap.	Yield per acre Sucrose Glucose Lbs. available sugar	25.20 12.90 .75 41.56
6	Mixed Minerals, ⅓ Dried Blood.	Yield per acre Sucrose Glucose Lbs. available sugar	21.81 —— —— ——
7	Mixed Minerals, ⅔ Dried Blood.	Yield per acre Sucrose Glucose Lbs. available sugar	22.75 13.20 .81 3822
8	Mixed Minerals, ⅓ Sulphate Ammonia.	Yield per acre Sucrose Glucose Lbs. available sugar	23.80 13.1 .79 3975
9	Mixed Minerals, ⅔ Sulphate Ammonia.	Yield per acre Sucrose Glucose Lbs. available sugar	23.56 13.40 .80 4029
10	No Manure.	Yield per acre Sucrose Glucose Lbs. available sugar	17.87 12.60 .65 2913
11	Mixed Minerals, ⅓ Nitrate Soda.	Yield per acre Sucrose Glucose Lbs. available sugar	20.55 12.90 .62 3411
12	Mixed Minerals, ⅔ Nitrate Soda.	Yield per acre Sucrose Glucose Lbs. available sugar	24.85 11.60 .72 3653

COMPARISON OF RESULTS.

			Excess over unfertilized plat.	Excess over Mixed Minerals.
Yield of unmanured plat		17.87		
"	Mixed Minerals plat	19.07	1.20 tons.	7.76
"	⅓ ration Cotton Seed Meal	26.83	8.96	6.48
"	⅓ " Fish Scrap	25.55	7.68	6.58
"	⅓ " Dried Blood	21.81	3.94	2.94
"	⅓ " Sulphate Ammonia	23.80	5.93	4.73
"	⅓ " Nitrate Soda	20.55	2.68	1.48
Average of all the ⅓ rations		23.71	5.84	4.64
Yield of ⅔ ration Cotton Seed Meal		26.25	8.38	7.18
"	⅔ " Fish Scrap	25.20	7.33	6.13
"	⅔ " Dried Blood	22.75	4.88	3.68
"	⅔ " Sulphate Ammonia	23.56	5.69	4.49
"	⅔ " Nitrate Soda	24.85	6.98	5.78
Average of all the ⅔ rations		24.52	6.65	5.45

It is apparent from the above that no form of Nitrogen is greatly superior as cane food to the others—a fact hitherto noticed in our results. While Cotton Seed Meal has given slightly the best results, it was also apparent early in the season that it occupied a most favorable position, while Sulphate of Ammonia and Dried Blood were unfavorably situated. The results clearly show that any of above forms of Nitrogen can be safely used by our sugar planters so far as availability is concerned, and the only question now for them to consider is their relative cost. That form which gives us Nitrogen at the least cost is, perhaps, the most desrable for cane.

Another feature of above experiments is worthy of note. Last year, under most favorable seasons, it was shown that 72 lbs. of Nitrogen per acre were excessive and extravagant. This year, with an extraordinary amount of rainfall and with a limited growth, 48 lbs. per acre have not been productive of largely increased yields over 24 lbs. The average of yields from ⅓ rations (24 lbs. per acre) is 23.71 tons per acre, while that of ⅔ rations (48 lbs. per acre(is only 24.52 tons, or an excess of only .81 ton. This shows that during the season just ended that the

cane was unable to appropriate more Nitrogen than that contained in 350 lbs. of Cotton Seed Meal, and that the excess applied above this quantity is still unused in the soil and may be counted on as reserved food for the coming year. But this was with plant cane, following a previous crop, on land in every fair tilth.

PART II.

This part of Plat XIV. was devoted to the trial of various formulas hitherto given to the public as adapted to cane.

No. 13, consisting of 280 ℔s Nitrate of Potash,
650 ℔s Acid Phosphate,
510 ℔s Gypsum,

is proscribed by Prof. George Ville, of the Government School at Vincennes, France, as specially adapted to plant cane. It is an expensive compound and experience here has shown excessive in Phosphoric Acid and deficient in Nitrogen.

No. 14 is a formula prescribed by the Experiment Station upon St. Denis, upon the island of Reunion (formerly Bourbon) and is highly endorsed by the planters of this island and Mauritius. It too is expensive and the quantity per acre much in excess of the ordinary requirements of our crops. It is as follows:

No. 14	140	℔s	Sulphate of Ammonia,
	100	"	Nitrate of Soda,
	120	"	Dried Blood,
	560	"	Acid Phosphate,
	80	"	Muriate Potash.

Here the Nitrogen is presented in three forms, which is believed to best meet the requirements of the plants.

Nos. 15, 16 and 17 are special manures made for cane crops by the Aglo Continental (late Ohlendorff's Guano Works, 15 Leadenhall street, London, E. C; They are styled:

Ohlendorff's "A" Special Cane Manure.
Ohlendorff's "B" Early Cane Manure.
Ohlendorff's "C" Dissolved Peruvian Guano.

They are all first-class goods, as the analyses elsewhere will show. The Nitrogen of these goods is in form of Ammonia and organic matter. They were applied to Experiments Nos. 15, 16 and 17 respectively, and at rate of 600 ℔s per acre of each. Mr. C. C. Crawford, No. 6 Tchoupitoulas street, New Orleans, is agent for sale of these wares and the Station is indebted to him for the goods used in these experiments.

The following is the diagram and table of result of these trials:

DIAGRAM OF PART II.—PLAT XIV.

PLANT CANE.

13	Ville's Formula.	Yield per acre	26.01
		Sucrose	13.20
		Glucose	.84
		Lbs. available sugar	4357
14	St. Denis Formula.	Yield per acre	30.05
		Sucrose	13.10
		Glucose	.90
		Lbs available sugar	4943
15	Ohlendorf's Special Cane Manure.	Yield per acre	29.16
		Sucrose	11.70
		Glucose	.90
		Lbs. available sugar	4225
16	Ohlendorf's Early Cane Manure.	Yield per acre	24.73
		Sucrose	12.40
		Glucose	.91
		Lbs. available sugar	3825
17	Ohlendorf's Dissolved Peruvian Guano.	Yield per acre	22.00
		Sucrose	15.70
		Glucose	.85
		Lbs. available sugar	3527

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RESULTS OF PART II. PLAT XIV.—PLANT CANE.

No. of Experiments.	Manures Used.	Yield per acre in tons	ANALYSES.			Co-efficient Purity.	Glucose Ratio.	lbs. available sugar upon 70 p. c. extract		When Harvested.
			Total Solids.	Sucrose.	Glucose.			Per ton.	Per acre.	
13	Ville's Formula	26.01	15.3	13.2	.84	86.27	6.36	169	4351	Dec. 7
14	St. Denis' Formula	30.05	15.2	13.1	.90	86.18	6.79	265	4943	"
15	Ohlendorff's "A" Special Cane Manure	29.16	13.5	11.7	.90	86.66	7.69	145	4225	
16	" "B" Early "	24.73	14.2	12.4	.91	87.32	7.33	155	3826	"
17	" "C" Dissolved Peruvian Guano	22.00	14.5	12.7	.85	87.58	6.69	160	3527	

The St. Denis formula has given the largest yields in this plat. It furnished 60 lbs. Nitrogen, 78 lbs. Phosphoric Acid, and 40 lbs. Potash to the acre, and was compounded out of the materials used elsewhere on this plat. Ohlendorff's "A" gave the next largest tonnage, it furnished 45 lbs. Nitrogen (in form of Sulphate of Ammonia), and about 65 lbs. Phosphoric Acid and 20 lbs. Potash.

PART III—PLAT XIV.

The object of this part of the plat was to determine, if possible, the proportions in which Cotton Seed Meal and Acid Phosphate should be mixed to give the best results on plant cane.

Cotton Seed Meal has been used alone on Experiment 18. In the other experiments it has been combined in such proportions with Acid Phosphate as to give the following ratios of Nitrogen to Phosphoric Acid, viz: 1—3, 1—2, 1—1, 2—1, and 3—1. In this combination no account has been taken of small amount of Phosphoric Acid in Cotton Seed Meal or of the still smaller amount in the insoluble form in the Phosphate. The Nitragen is reckoned at 7 per cent in the Meal and the Soluble Phosphoric Acid at 14 per cent. in the Phosphate. The combination was used at rate of 750 lbs per acre. The following are the quantities used:

Experiment No. 18—	650 pounds	Cotton Seed Meal.	
" " 19—	300 " 450 "	" " " Acid Phosphate	Nitrogen 1 to Phos. Acid 3
" " 20—	375 " 375 "	Cot. Seed Meal Acid Phosphate	" 1 to " " 2
" " 21—	Nothing.		
" " 22—	500 pounds 250 "	Cot. Seed Meal Acid Phosphate	" 1 to " " 1
" " 23—	600 " 150 "	Cot. Seed Meal Acid Phosphate	" 2 to " " 1
" " 24—	650 " 100 "	Cot. Seed Meal Acid Phosphate	" 3 to " " 1

This portion of plat was left in the field till January 11th in order to test diffusion on standing frosted cane. It was killed by the frost of December 17th, but not seriously injured. Its sugar content was intact when worked.

DIAGRAM OF PART III—PLAT XIV.

18	Cotton Meal (alone).	Yield per acre	18.69
		Sucrose	11.90
		Glucose	.71
		Lbs. available sugar	2839
19	Nitrogen 1	Yield per acre	19.48
	to	Sucrose	14.20
	Phosphoric Acid 3.	Glucose	.39
		Lbs. available sugar	3623
20	Nitrogen 1	Yield per acre	20.07
	to	Sucrose	14.80
	Phosphoric Acid 2.	Glucose	.56
		Lbs. available sugar	3914
21	No Manure.	Yield per acre	16.97
		Sucrose	11.40
		Glucose	.76
		Lbs. available sugar	2435
22	Nitrogen 1	Yield per acre	22.75
	to	Sucrose	12.20
	Phosphoric Acid 1.	Glucose	.75
		Lbs. available sugar	3536
23	Nitrogen 2	Yield per acre	24.50
	to	Sucrose	13.40
	Phosphoric Acid 1.	Glucose	.71
		Lbs. available sugar	4241
24	Nitrogen 3	Yield per acre	33.80
	to	Sucrose	13.40
	Phosphoric Acid 1.	Glucose	.78
		Lbs. available sugar	4082

RESULTS OF PART III—PLAT XIV. PLANT CANE.

No. of Exp't.	Manures Used.	Yield per acre in tons.	ANALYSES. Total Solids.	Sucrose.	Glucose.	Purity coefficient.	Glucose Ratio.	Lbs. available sugar upon 70 p. c. extraction Per ton.	Per acre.	When Harvested.
18	Cotton Seed Meal alone	18.69	13.8	11.9	.71	86.23	5.96	152	2839	Jan 11, 1889
19	Nitrogen 1, Phos. Acid 3	19.48	15.7	14.2	.59	90.44	4.15	186	3623	" "
20	Nitrogen 1, Phos. Acid 2	20.07	16.2	14.8	.56	91.35	3.78	195	3914	" "
21	No manure	16.97	12.9	11.4	.76	88.37	6.66	114	2435	" "
22	Nitrogen 1, Phos. Acid 1	22.75	13.	12.2	.75	93.84	6.14	155	3536	" "
23	Nitrogen 2, Phos. Acid 1	24.53	15.2	13.4	.71	88.15	5.29	173	4241	" "
24	Nitrogen 3, Phos. Acid 1	28.80	15.3	13.4	.78	87.01	5.82	172	4082	" "

It will be seen from above that No. 23—Nitrogen 2 to Phosphoric Acid 1—has given the largest tonage, while No. 20, Nitrogen 1 to Phosphoric Acid 2, has given the largest sugar content.

SUMMARY OF RESULTS.

The year just closed has served to emphasize, in a most positive manner, the deductions of former years. Never before have properly compounded manures exhibited such results in tonnage and sugar content. This is easily explained by reference to the weather table at the end of this bulletin, showing one of the wettest seasons ever known. Early in May the rains began, forcing the roots of the cane near the surface, thus restricting their foraging areas. Those plants which were properly manured grew well developed stalks, despite the limited areas, wet weather and unfavorable seasons; while those unmanured, limited in all their resources, made small and watery stalks. It has not been, however, a year of heavy tonnage or large sugar content; but pre-eminently one of low glucose content, thereby making nearly all of the sugar present available. The experiments here are sufficiently pronounced in their results to convince the most skeptical of the efficacy ot manures on cane, when they are properly compounded and intelligently applied.

Many of the questions last year were propounded to plant cane, with satisfactory replies. This year the stubble has been permitted a hearing, and its reply is fully in accord with the recorded evidence of the plant cane. Let us hear the year's testimony.

1st. That the upper portion of the cane is the equal, if not the superior, to the lower part, giving unmistakeable evidence of this both in its first and second years' growth.

2nd. That there was but little difference in the stubble of those plats whereon different number of stalks were used in planting.

3d. That seed from good first year stubble has given as good results the first and second year as seed from plant.

4th. Conclusively that stubbles (rattoons) come equally as well (and perhaps better) from the original sprouts as from suckers.

5th. That Nitrogen in some form is badly needed by our soils to grow cane, and while Sulphate of Ammonia furnishes it in a form slightly better adapted to our wants, there is, how-

ever, no marked superiority over any of the leading forms; a gratifying fact, permitting the use of Cotton Seed Meal, a cheap home product, instead of an expensive imported article.

6th. That excessive quantities of Nitrogen are always injurious to sugar content, and this year have only been partially utilized by the crop, suggesting waste and extravagance. Quantities varying from 21 to 42 lbs. (that which is found in from 300 to 600 lbs. of Cotton Seed Meal) to the acre, are strongly suggested as the limits of profitable production by the experiments of the past three years. However, to produce maximum results, Nitrogen should be properly combined with Mineral Manures.

7th. The Mineral Manures alone are without decided effects (save on new grounds and pea vine fallows, and often here much improved by proper combination with Nitrogen), but combined properly with Nitrogen, are productive of the highest results.

8th. That the Phosphoric Acid needed by our soils is best supplied in the soluble form as Acid or Superphosphate. The insoluble forms in Charleston Floats, Orchella and Grand Cayman Guanos, seem also to be available after awhile; the time depending upon character of soil and fineness of fertilizer.

9th. That excessive quantities of Phosphoric Acid, while not beneficial, are not, as commonly supposed, lost—since this substance, neither leaching nor evaporating, may serve the plant in the future. The practice of supplying excessive quantities to the plant is, to say the least, *not economical.* The limits of profitable production seem to be between 40-75 lbs. per acre.

10th. That Potash under any form, in small quantities, is without visible effect either upon tonnage or sugar content; but when used in excessive quantities for several years upon same soil, has given increased tonnage without enhancing the sugar content.

11th. That the influence of a crop of pea vines turned under is more perceptible to the stubble than to the plant cane.

12th. That draining lands by tiles has increased the yields in '86-87 by about 35 per cent and '88 by 50 per cent.

13th. That the effects of tiles are yearly increasing and are now perceptible in adjoining plats.

14th. That growing cane in narrow rows has given this year

increased tonnage and *sugarage* per acre, and is worthy of further investigation.

15th. That the station has this year grown forty-eight varieties of foreign cane, some of which are full of promise.

With these deductions the intelligent planter can easily formulate a manure adapted to his soil and crop. If his lands are fresh or have just been in pea vines, his plant cane will need only small quantities of Nitrogen, but a goodly portion of Phosphoric Acid. One part of Nitrogen to two parts of Phosphoric Acid will probably be the best proportion for his mixture. These are obtained by mixing Cotton Seed Meal and a 14 per cent Acid Phosphate in equal parts.

On succession cane, or stubble cane, or even plant cane upon poor or black stiff lands, more Nitrogen is required, and the quantity should be increased just in proportion to the poverty or stiffness of the land and the age of the stubble. Nitrogen may equal, or even greatly exceed, the Phosphoric Acid. A mixture of two parts of Cotton Seed Meal to one part of Acid Phosphate furnishes Nitrogen and Phosphoric Acid in about equal parts; while three parts of Meal and one of Acid Phosphate will give one and a-half times more Nitrogen than Phosphoric Acid—a mixture very desirable sometimes upon old stubble or land long subjected to continuous (succession) cane Under no circumstances ought the above mixtures to be used in quantities larger than 900 lbs. per acre, and it is highly desirable that the minimum limit should not fall below 500 lbs. More than this maximum quantity cannot be assimilated by the cane plant prior to the desired time of maturing, viz., early in September. Less than the minimum quantity gives an early vigor of leaf and root to the young plant, which is too soon summarily checked by the exhaustion of the manure, and the plant either prematurely ripens or languishes into a slow and unhealthy growth.

In the application of manure great care should be exercised that it becomes as thoroughly mixed with the soil as possible. It is advisable to apply, at least, a portion of the manure under the cane at the time of planting. Phosphatic and Potassic manures can then be used with impunity, for they neither leach

nor evaporate. Indeed, it is positively asserted that Potassic manures, to succeed best, should always be applied several months before needed by the plant. Only Nitrogen manures suffer loss by leaching, and hence a portion of these may with propriety be withheld till the cultivation of the plant. However, in our soils, the leaching out of Nitrates is done in such small quantities as to elicit little or no uneasiness. As a rule, Phosphatic and Potassic manures, particularly the latter, should be put at the depth required by the roots of the plants. They become fixed as soon as they come in contact with the soil. While Nitrogenous manures should always be placed above the roots of the plant, since they have a tendency downward, some of them are best applied as top dressing, while all do best when not buried too deeply.

Below is appended the analyses of the different fertilizers used in the above described experiments. They are inserted with the double purpose, first, of giving to the professional student the exact data for working up accurately the above recited experiments, and second, of familiarizing our planters with the names and composition of the various fertilizers now on our market. The monthly record of the weather for the year 1888, together with a condensed statement of the year, is also given. A close examination of these tables will materially aid in explaining the crop results of the past year.

ANALYSIS OF FERTILIZERS USED BY SUGAR EXPERIMENT STATION IN YEAR 1888.

Name of Article.	Where Procured.	Nitrogen.	Phosphoric Acid			Potash.
			Soluble.	Reverted.	Insoluble.	
Bradley's Fertilizer	Mr. F. M. Ames, Boston	2.66	8.11	2.10	1.69	3.04
Bowker's "	" "	2.10	7.36	4.16	2.94	2.02
Ohlendorf's Special Cane Manure "A"	Mr. C. C. Crawford, New Orleans	8.14	9.60	1.73	.83	3.76
Ohlendorf's Early " " "B"	" "	4.06	7.00	1.80	.45	8.34
Ohlendorf's Dissolved Peruvian Guano "C"	" "	7.41	9.40	1.02	.26	2.37
Grand Cayman's Phosphate	Mr. A. B Bowter, New York	......	......	3.59	22.57	......
Orchilla Guano	Messrs. Yeavers, Snead & Co., Richmond, Va.	......	......	4.24	15.36	......
Bone Meal	Map's Fertilizing Company, New York	3.78	......	.....	20.93	......
Cotton Seed Meal	Maguinis Oil Works, New Orleans	7.12	......	......	3.77	1.96
Acid Phosphate	Planters' Fertilizing Company, New Orleans	......	13.92	.70	.54	......
Tankage	Mape's Fertilizing Company, New York	7.00	......	...	12.48	......
Fish Scrap	" " " "	7.14	......	......	3.52	......
Dried Blood	" " " "	13.79	......	......	......	......
Nitrate of Soda	" " " "	16.23	......	......	......	......
Sulphate of Ammonia	" " " "	20.59	.....	......	......	......
Kainite	Planters' Fertilizing Company, New Orleans	......	......	......	......	12.00
Nitrate Potash	......	13.8	......	......	......	
Muriate Potash	......	......	......	......	......	
Sulphate Potash	......	......	......	......	......	

RECORD OF WEATHER LOUISIANA SUGAR EXPERIMENT STATION FOR JANUARY, 1888.

DATE.	TEMPERATURE.					RAINFALL.
January.	9 a. m.	3 p. m.	9 p. m.	Maximum.	Minimum.	Inches.
1	50°	50°	43°	51°	32°	.35
2	42	55	40	55	33	
3	46	62	46	62	41	
4	56	72	66	72	62	
5	66	77	68	77	65	
6	68	75	68	77	66	
7	70	74	68	76	65	
8	69	75	63	77	55	
9	58	56	51	58	44	.64
10	45	49	48	49	39	.76
11	46	50	48	50	45	
12	58	72	68	74	60	
13	64	68	57	69	55	
14	69	73	70	75	67	
15	71	70	45	76	36	
16	38	48	42	48	37	
17	47	56	52	57	33	
18	37	43	36	43	28	.20
19	32	43	34	45	30	
20	49	56	53	59	45	1.55
21	65	68	57	69	52	
22	56	57	54	57	..	
23	..	..	..	..	..	
24	..	..	..	..	..	
25	54	63	55	63	..	.24
26	51	52	53	60	46	
27	54	63	52	67	39	
28	51	60	..	..	45	
29	58	65	53	61	38	
30	51	70	60	70	47	
31	51	60	62	69	42	
Aver.	54.2	61.7	54			3.77

Maximum Temperature, 77°.
Minimum " 30°.

Daily Rainfall, .12.

RECORD OF WEATHER LOUISIANA SUGAR EXPERIMENT STATION FOR FEBRUARY, 1888.

Date.	Temperature.					Rainfall.
February.	9 a. m.	3 p. m.	9 p. m.	Maximum.	Minimum.	Inches.
1	60°	69°	60°	72°	54°	
2	62	63	63	63	52	
3	63	65	59	63	61	1.
4	55	63	58	65	53	
5	56	65	58	65	51	.35
6	54	57	54	57	50	
7	53	65	58	67	47	
8	55	69	61	69	56	
9	61	74	66	76	56	
10	67	73	65	73	64	
11	61	72	61	72	60	1.13
12	47	57	50	57	45	
13	53	65	53	65	44	
14	55	71	60	71	45	
15	65	65	60	67	52	
16	59	60	55	62	48	
17	60	55	55	65	49	
18	53	68	61	70	46	
19	67	70	65	73	50	
20	66	65	60	66	54	
21	58	59	58	59	56	2.95 (20–22)
22	60	61	58	61	56	
23	..	..	63	63	58	2.20
24	62	63	55	67	60	2.17
25	57	63	53	64	47	
26	55	62	50	62	47	
27	53	55	45	56	40	
28	42	57	44	57	37	
29	56	68	54	68	39	
Aver.	57.6	64.2	57.6			9.80

Maximum Temperature, 76°.
Minimum " 37°.

Daily Rainfall, .316.

RECORD OF WEATHER LOUISIANA SUGAR EXPERIMENT STATION FOR MARCH, 1888.

DATE.	TEMPERATURE.					RAINFALL.
March.	9 a. m.	3 p. m.	9 p. m.	Maximum.	Minimum.	Inches.
1	61°	76°	63°	77°	50°	
2	70	76	63	77	54	
3	65	75	..	78	56	
4	..	..	..	78	..	1.
5	57	59	55	59	55	
6	51	59	52	59	46	
7	43	57	53	59	41	
8	47	61	49	61	40	
9	58	70	64	71	45	
10	67	75	65	76	61	.03
11	50	53	48	54	44	
12	46	55	49	55	40	
13	48	60	50	64	36	
14	54	65	51	66	41	
15	54	60	51	60	46	
16	50	68	55	68	37	
17	55	74	62	74	47	
18	62	77	65	77	50	
19	67	65	63	69	62	1.55
20	68	76	60	76	61	.03
21	50	62	55	62	43	
22	50	57	47	57	45	
23	56	64	53	65	40	
24	63	67	65	69	49	.30*
25	70	74	70	74	61	.92
26	72	74	70	76	56	1.42
27	72	76	71	76	68	.08
28	71	68	59	76	69	.46
29	55	66	60	67	52	
30	62	74	63	74	53	
31	65	77	65	78	55	
Aver.	57	65	55.			5.79

Maximum Temperature, 78°.
Minimum " 36°.

Daily Rainfall, .18.

RECORD OF WEATHER LOUISIANA SUGAR EXPERIMENT STATION FOR APRIL, 1888.

Date.	Temperature.					Rainfall.
April.	9 a. m.	3 p. m.	9 p. m.	Maximum.	Minimum.	Inches.
1	67°	78°	70°	78°	61°	
2	72	79	70	79	66	
3	75	81	68	82	63	
4	71	83	73	83	64	
5	77	84	74	84	69	
6	74	84	..	84	67	
7	..	84	74	85	67	
8	77	86	73	81	67	
9	75	81	72	81	67	
10	75	81	70	82	64	
11	76	82	69	83	63	.13
12	66	65	62	66	65	.23
13	65	74	62	74	57	
14	66	76	63	77	56	
15	70	79	67	80	55	
16	72	81	66	81	56	
17	72	81	68	81	56	
18	73	77	68	78	58	
19	75	83	70	84	65	
20	75	81	73	83	63	
21	67	73	65	73	58	
22	74	80	70	81	54	
23	76	85	68	85	60	.52
24	66	69	65	71	63	.03
25	74	74	67	74	58	
26	72	72	66	73	64	
27	73	75	66	75	62	
28	75	78	70	79	60	
29	77	75	70	82	60	
30	70	80	69	80	66	
Aver.	72.3	78.7	69.2			.91

Maximum Temperature, 85°.
Minimum " 54°.

Daily Rainfall, .029.

RECORD OF WEATHER LOUISIANA SUGAR EXPERIMENT STATION FOR MAY, 1888.

DATE.	TEMPERATURE.					RAINFALL.
May.	9 a. m.	3 p. m.	9 p m.	Maximum.	Minimum.	Inches.
1	67°	75°	66°	75°	58°	
2	78	81	69	83	54	
3	74	83	74	83	58	
4	80	75	70	81	65	
5	77	70	67	80	65	
6	72	68	72	82	64	.79
7	77	70	77	80	68	.61
8	78	84	75	85	60	
9	78	83	75	84	63	
10	81	69	70	89	68	
11	78	81	68	86	68	1.10
12	80	79	75	87	64	.64
13	71	78	68	78	63	
14	79	87	73	89	58	
15	75	82	72	83	62	
16	80	85	72	88	62	
17	83	84	75	88	66	
18	82	86	76	90	67	
19	83	73	70	83	69	3.30
20	74	80	75	80	66	1.22
21	76	82	74	82	63	
22	79	84	75	88	68	
22	79	85	75	86	66	
24	81	67	69	88	67	1.14
25	81	69	74	87	64	1.53
26	79	85	77	87	65	
27	83	85	77	90	71	
28	87	80	76	92	72	
29	82	74	74	90	70	
30	82	76	72	85	68	1.44
31	74	80	73	80	67	
Aver.	78.7	78.7	72.7			11.77

Maximum Temperature, 92°.
Minimum " 54°.

Daily Rainfall, .379.

RECORD OF WEATHER LOUISIANA SUGAR EXPERIMENT STATION FOR JUNE, 1888.

Date.	Temperature.					Rainfall.
June.	9 a. m.	3 p. m.	9 p. m.	Maximum.	Minimum.	Inches.
1	81°	..	75°	89°	65°	
2	81	84°	74	85	66	
3	80	83	76	83	70	
4	77	79	75	85	66	
5	82	..	..	..	66	
6	86	74	74	88	70	2.34
7	82	83	74	83	67	
8	84	76	77	89	67	
9	80	84	77	89	70	
10	87	87	77	91	69	
11	85	87	78	91	71	
12	84	87	78	89	78	
13	84	86	76	90	72	.75
14	78	75	76	81	72	.10
15	84	84	76	89	72	.89
16	87	82	77	87	72	.21
17	83	81	76	85	73	.94
18	81	84	77	86	72	.28
19	84	81	77	86	74	.16
20	84	87	80	90	75	
21	80	82	79	85	76	.16
22	81	81	76	91	76	.79
23	84	79	76	87	73	.52
24	84	79	76	92	73	.01
25	85	77	76	91	73	.83
26	76	78	75	80	73	.40
27	79	86	82	87	71	
28	85	90	82	91	76	
29	78	88	81	90	73	.31
30	88	89	83	92	76	
Aver.	82.4	80.1	77.1			8.69

Maximum Temperature, 92°.
Minimum " 65°.

Daily Rainfall, .289.

RECORD OF WEATHER LOUISIANA SUGAR EXPERIMENT STATION FOR JULY, 1888.

DATE.	TEMPERATUBE.					RAINFALL.
July.	9 a. m.	3 p. m.	9 p. m.	Maximum.	Minimum.	Inches.
1	84°	85°	84°	93°	73°	
2	89	83	81	92	74	
3	89	84	80	89	74	.28
4	86	84	80	87	74	.17
5	87	85	81	87	75	.18
6	86	89	81	92	74	.01
7	86	85	79	92	75	1.28
8	90	87	78	94	74	.18
9	89	89	81	93	74	.10
10	85	82	82	93	75	.02
11	85	84	82	87	75	.77
12	85	88	83	94	76	.52
13	87	92	80	95	76	
14	87	93	80	97	77	
15	88	84	84	98	77	
16	90	80	78	98	78	.20
17	86	86	79	88	75	.16
18	84	86	80	89	74	.95
19	86	83	80	89	73	.10
20	..	..	81	87	73	
21	83	88	78	89	73	
22	84	..	80	93	72	
23	89	92	81	93	72	
24	80	91	82	97	75	
25	86	92	80	95	75	
26	91	92	83	94	..	
27	86	88	78	97	76	.03
28	90	87	..	92	71	
29	88	91	82	94	73	.01
30	88	92	83	94	75	
31	96	81	80	96	77	.42
Aver.	87	81	78			5.49

Maximum Temperature, 98°.
Minimum " 71°.

Daily Rainfall, .18.

RECORD OF WEATHER LOUISIANA SUGAR EXPERIMENT STATION FOR AUGUST, 1888.

Date.	Temperature.					Rainfall.
August.	9 a. m.	3 p. m.	9 p. m.	Maximum.	Minimum.	Inches.
1	39°	94°	80°	95°	74°	.02
2	90	84	81	95	76	.45
3	88	79	78	92	77	.60
4	86	86	79	89	75	.10
5	86	82	80	93	74	.15
6	86	84	82	94	75	
7	87	83	80	94	74	.28
8	73	82	79	82	71	1.
9	84	83	78	89	70	.02
10	84	80	79	91	72	
11	84	83	79	89	71	
12	79	81	79	83	73	.41
13	83	87	80	88	73	
14	83	80	76	87	73	
15	75	75	75	76	72	3.90
16	81	83	78	86	72	.50
17	82	88	80	88	73	
18	81	83	78	86	76	.04
19	77	75	75	87	73	2.91
20	86	77	77	80	74	1.75
21	86	81	79	87	76	.02
22	87	82	77	87	87	.03
23	86	83	77	89	74	.01
24	79	80	77	83	73	1.50
25	80	77	77	83	73	.38
26	82	85	80	87	73	.02
27	83	84	80	88	72	
28	82	79	79	89	75	1.20
29	82	84	79	87	74	
30	85	77	78	86	76	.51
31	85	78	77	86	73	
Aver.	83.2	82	78.4			15.80

Maximum Temperature. 95° — Daily Rainfall, .509.
[illegible] 70°

RECORD OF WEATHER LOUISIANA SUGAR EXPERIMENT STATION FOR SEPTEMBER, 1888.

DATE.	TEMPERATURE.					RAINFALL.
September.	9 a. m.	3 p. m.	9 p. m.	Maximum.	Minimum.	Inches.
1	80°	85°	79°	86°	74°	
2	79	80	77	85	73	
3	80	78	76	88	74	.19
4	87	79	77	87	72	1.60
5	82	85	80	86	73	
6	81	88	80	89	75	
7	88	85	79	88	75	.72
8	82	85	79	87	73	
9	79	86	76	86	74	.02
10	82	82	75	87	73	
11	80	83	76	87	72	
12	84	88	77	88	71	
13	82	86	76	87	72	
14	71	75	74	87	72	.76
15	75	99	75	80	71	
16	76	78	75	80	71	
17	76	82	74	83	73	
18	78	80	75	83	68	
19	82	84	75	84	71	
20	80	85	74	85	67	
21	82	78	86	81	68	
22	81	88	78	89	73	
23	80	99	74	81	73	
24	75	76	74	78	66	
25	76	78	72	79	65	
26	74	79	76	79	60	
27	75	82	75	82	61	
28	74	77	67	77	60	
29	66	73	65	73	58	
30	65	72	61	73	57	
Aver.	78.4	81.3	75.2			3.29

Maximum Temperature, 89°.
Minimum " 57°.

Daily Rainfall, .109.

RECORD OF WEATHER LOUISIANA SUGAR EXPERIMENT STATION FOR OCTOBER, 1888.

DATE.	TEMPERATURE.					RAINFALL.
October.	9 a. m.	3 p. m.	9 p. m.	Maximum.	Minimum.	Inches.
1	67°	77°	72°	80°	63°	
2	68	78	74	82	63	
3	69	77	77	86	63	
4	71	82	72	84	66	
5	72	77	71	83	64	
6	70	76	69	84	63	
7	64	74	68	83	59	
8	67	74	66	74	59	
9	66	73	67	73	60	
10	65	73	63	74	59	
11	66	74	66	72	60	
12	66	73	66	74	60	
13	63	74	63	74	58	
14	64	73	64	74	59	
15	72	81	72	84	62	
16	73	83	74	85	59	
17	72	81	72	85	58	
18	72	79	71	85	60	
19	71	78	70	85	61	
20	70	77	68	83	60	
21	68	76	66	84	61	1.
22	70	75	69	82	67	1.10
23	68	70	67	73	64	1.
24	64	65	64	66	62	
25	64	71	65	74	63	
26	69	74	70	78	58	
27	74	76	70	79	56	.30
28	72	77	73	78	60	
29	64	75	60	74	56	
30	63	74	59	74	54	
31	67	77	70	78	53	
Aver.	68.	75.5	68.3			3.40

Maximum Temperature, 85°.
Minimum " 53°.

Daily Rainfall, .096.

RECORD OF WEATHER LOUISIANA SUGAR EXPERIMENT STATION FOR NOVEMBER, 1888.

Date.	Temperature.					Rainfall.
November.	9 a m.	3 p. m.	9 p. m.	Maximum.	Minimum.	Inches.
1	71	78	73	82	64	
2	74	79	70	80	62	
3	72	76	72	84	69	
4	74	75	74	82	68	.20
5	70	81	70	84	67	
6	72	81	72	81	68	
7	70	79	69	80	60	
8	76	80	71	81	60	1.
9	51	56	52	58	48	
10	52	58	52	61	45	
11	55	62	53	63	44	
12	59	64	61	65	43	
13	61	66	63	67	57	.50
14	65	69	66	74	60	
15	67	69	66	73	60	
16	68	69	67	69	48	
17	68	75	66	76	58	
18	..	..	..	..	..	
19	60	64	59	63	56	.10
20	59	62	58	62	56	
21	58	59	57	60	44	.05
22	59	60	57	60	55	
23	59	60	57	60	56	
24	51	59	54	59	54	
25	..	..	..	62	42	
26	48	50	47	51	44	.15
27	47	49	47	51	34	
28	46	51	47	56	34	
29	46	51	..	56	34	
30	46	53	49	52	37	.50
Aver.	60.8	65.5	61			2.50

Maximum Temperature, 84°.
Minimum " 34°.

Daily Rainfall, .083.

RECORD OF WEATHER LOUISIANA SUGAR EXPERIMENT STATION FOR DECEMBER, 1888.

DATE.	TEMPERATURE.					RAINFALL.
December.	9 a. m.	3 p. m.	9 p. m.	Maximum.	Minimum.	Inches.
1	48°	51°	48°	53°	45°	
2	55	59	48	62	38	
3	48	58	53	61	46	
4	51	59	48	59	42	
5	52	60	49	62	42	
6	49	59	48	61	37	
7	52	64	54	64	49	
8	55	64	59	65	50	
9	55	60	54	62	50	.95
10	55	56	48	57	39	1.2
11	48	55	48	62	37	
12	49	65	55	66	49	
13	55	57	50	58	36	
14	50	61	53	65	42	
15	55	69	65	70	49	1.2
16	55	67	53	69	48	
17	..	..	..	..	..	
18	48	54	42	55	37	
19	46	51	41	53	34	
20	41	54	34	55	27	
21	39	60	40	61	35	
22	42	60	45	61	40	
23	59	60	55	62	39	
24	55	70	55	71	40	
25	58	70	63	71	46	.02
26	56	70	55	71	40	1.5
27	48	59	49	60	36	
29	46	51	44	53	38	
29	46	59	48	59	44	
30	57	65	63	68	55	
31	61	66	61	68	52	.25
Aver.	51.	60.	50.			4.12

Maximum Temperature, 71°.
Minimum " 27°.

Daily Rainfall, .132.

CONDENSED WEATHER RECORD OF SUGAR EXPERIMENT STATION FOR THE YEAR 1888.

MONTH.	Average Temperature 9 a. m.	Average Temperature 3 p. m.	Average Temperature 9 p. m.	Total Average.	Maximum Temperature.	Minimum Temperature.	Rainfall in Inches.
January	54.2°	61.7°	54°	56.6	77°	30°	3.77
February	57.6	64.2	57.6	59.8	76	37	9.80
March	57.	65.	55.	59.	78	36	5.79
April	72.3	78.7	69.2	73.4	85	54	.91
May	78.7	78.7	72.7	76.7	92	54	11.77
June	82.4	80.1	77.1	79.8	92	65	8.69
July	87.	81.	78.	82.	98	71	5.49
August	83.2	82.	78.4	81.2	95	70	15.80
September	78.4	81.3	75.2	77.3	89	57	3.29
October	68.	75.5	68.3	70.6	85	53	3.40
November	60.8	65.5	61.	62.4	84	34	2.50
December	51.	60.	50.	53.6	71	27	4.12

Average Temperature for Year, 69° 3′.
Maximum " " 98°.
Minimum " " 27°.

Average Temperature Winter Months, 56° 6′.
" " Spring " 69° 7′.
" " Summer " 81°.
" " Fall " 70° 1′.

Total Rainfall for Year, 75.33 inches.
" " Winter Months, 17.69 inches.
" " Spring " 18.47 "
" " Summer " 29.98 "
" " Fall " 9.19 "

REPORT

OF THE

STATE EXPERIMENT STATION,

BATON ROUGE, LA.

FOR

1888.

BULLETIN NO. 21.

WM. C. STUBBS, A. M., Ph. D., Director.
D. N. BARROW, B. S., Assistant Director.

—ISSUED BY—

THOMPSON J. BIRD,

COMMISSIONER OF AGRICULTURE, BATON ROUGE, LA.

BATON ROUGE:
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1889.

LOUISIANA STATE UNIVERSITY AND A. AND M. COLLEGE,
OFFICE STATE EXPERIMENT STATION,
BATON ROUGE, LA., January, 1889.

Major T. J. Bird, Commissioner of Agriculture, Baton Rouge, La.:

Dear Sir—I hand you annual report of Mr. D. N. Barrow, Assistant Director State Experiment Station, Baton Rouge, La., and request that you publish the same as Bulletin No. 21.

Respectfully submitted,

WM. C. STUBBS, Director.

STATE EXPERIMENT STATION,
BATON ROUGE, January, 1889.

To Dr. W. C. Stubbs, Director:

Dear Sir—Herewith I hand you results of work done on this Station for the year ending December 31, 1888. When the Station was established here in January of that year there was nothing but an old field. The work of preparing this land for the reception of plants necessarily delayed planting all crops until rather late. However, a good deal has been accomplished; as I hope the accompanying report shows.

Very respectfully,

DAVID N. BARROW,

Assistant Director.

Location, Improvements, Soil, Etc.

The State Experiment Station is located on ground formerly belonging to the United States and used as a garrison. It has recently been donated to the State University and Agricultural and Mechanical College, and by it assigned to the use of the Station. On account of a sinuous bayou running through this tract, preventing accessibility during high water, the buildings had to be erected at the extreme Eastern end of the tract, directly on the road which leads to Bayou Sara and Clinton. This tract of land is located on what is termed geologically the "Bluff Formation," and its soil is a brown loam containing some clay, formerly very rich, but now greatly reduced in fertility. This loam is underlaid at a depth of 4 to 10 feet by the calcareous silts of the Loess formation. A neat barbed wire fence encloses most of the tract. This entire tract had been for years the "commons" of Baton Rouge and had been severely depastured by numerous cattle and horses. It was densely covered with a mixture of carpet, Bermuda and Coco grasses. Of the carpet (Paspalum) grasses no less than five or six distinct species were found; among them the soon-to-become famous Louisiana Grass "Paspatalum Ovatum," now advertised so largely in the North.

This turf land had to be transformed into a station and the work accomplishing it has been of a Herculean kind. The following houses have been erected: A neat and substantial dwelling, a stable for mules and cows, a large barn and necessary poultry houses. In the barn is an ensilage cutter, scientific grinding mill and a twenty-saw improved Gullett gin, with feeder and condenser. The last was made to order and is used to gin the cotton experimented on. These are run by a Bookwater engine and boiler; the power being first transmitted to a 35-foot shaft, running across the north end of the barn. The

engine and boiler, outside of barn, is enclosed in a neat house 10x10, covered like the barn with corrugated iron.

In the rear of the house a garden of about one-half acre has been neatly enclosed, while the front yard, barn yard and fruit orchard have been securely enclosed with a combination wire and plank fence. Paint and whitewash have been freely used to give durability to the structures and attractiveness to the Station. Connected with the barn are three platform scales, weighing from a fraction of an ounce to five tons—affording excellent facilities for weighing all farm products.

LIVE STOCK.

Two fine mules—an inheritance from the old Station—constituted our live stock, at the beginning of the present year. Since that time there has been added three Holstein and two Jersey cattle, and ten varieties of chickens and one of ducks. The Holsteins were purchased of Mr. J. W. Howard, Aberdeen, Miss., and are of the celebrated Aggie strain. The Jerseys were procured from Dr. Wm. E. Oates, Vicksburg, Miss., and represent about 75 per cent of the celebrated St. Lambert blood. It is proposed as soon as possible to add other breeds of cattle. Also, hogs and sheep.

Our Holstein cow, the only one now to the pail, is a beautiful four-year-old animal, and gives five gallons of milk per day. She is fed daily upon the following ration, which costs 27 cents, viz:

4	pounds	Cotton Seed Meal.
4	"	Wheat Bran.
6	"	Corn and Cob Meal.
18	"	Pea Vine Hay.

It takes less than one quarter of the time of one man to attend this cow. If we put this at 33 cents per day, the cost of the cow for feed will be 60 cents per day. Against this then is a credit of five gallons of milk worth $1.50—leaving 90 cents a day profit for a good cow, well kept. Few investments pay so well and later this expense can be considerably reduced by pasturage, for at the present date, January 15th, the University campus is

green with white clover. That dairying and stock-raising can be made exceedingly profitable all over the South (particularly on these bluff lands where Bermuda and white clover grow in almost tropical luxuriance), admits of scarcely a doubt.

From eggs purchased of W. W. Garig, the pioneer poultry raiser in the South, the following varieties of poultry have been raised: Black Minorcas, Langshans, Barred and White Plymouth, Partridge and Buff Cochins, Brown Leghorn, Light Brahmas, Wyandottes and Houdans of chickens, and Pekin of ducks. Some of each variety have been sent to the North Louisiana Experiment Station. Our losses have been heavy by petty thieves, but hereafter with separate pens for each, it is hoped that such depredations will be discontinued.

GARDEN AND ORCHARD.

In the garden forty-eight varieties of strawberries, seven varieties of raspberries and one of blackberries have been planted. These were secured too late to judge of the merits of each variety last year, but they are all now fairly started and comparative results are promised the ensuing spring. A large number of strawberry plants have been gratuitously distributed over the State, and next year a much larger quantity can be spared.

A large orchard, embracing two of the leading varieties of almonds, nectarines, apricots, plums, peaches, filberts, Japanese persimmons, apples, pears, figs and chestnuts has been planted, and is now doing well, despite the awful storm of August 19th. A vineyard of thirty varieties has also been planted and most of the varieties made a good growth of wood the first year.

The results of potatoes, peas and small grains have already been given to the public in Bulletin No. 17. The ground between the trees in the orchard was last year utilized in growing a number of varieties of watermelons and canteloupes.

FORAGE PLANTS.

The following varieties of sorghum were grown with the double purpose of testing their adaptability to sugar making and

for forage purposes. At various stages of growth they were carefully analyzed and results published in Bulletin No. 19. In same Bulletin will be found an account of the shipment of a car-load of Early Orange cane to Sugar Experiment Station and there manufactured into sugar.

The following are the varieties of Sorghum used: Early Amber, Early Orange, Links Hybrid, Honduras, Chinese, and a cross between Early Amber and Honduras. Besides these the non-saccharine Sorghums, Rural Branching, Kaffir Corn, Milo Maize and White Dhoura were also planted. Teosinte and Pearl Millet completed our list of large forage crops. All yielded well, giving two and a-half crops of excellent fodder, but exact results cannot be given since our platform scales, ordered early in summer, were delayed "in transitu," and did not reach us in time for our summer crops. The Kaffir Corn is noted for its large yield of seed, but in this country, where the English sparrow abounds, small seeded plants have little chance for reproduction. Of all the crops mentioned above, covering an area of over three acres, not a single seed was saved. These little pests devouring them all in spite of scarecrows, shotguns and poison. The following Field Peas were planted, Pea of the Backwoods, Lady Pea, Unknown Pea, Large White Pea, White Prolific Pea, Whippoorwill, Conch & Clay. These were planted on the 11th of May.

The following notes were made during growth:

Pea of the Backwoods, also called the Poor Man's Friend—One foot long, erect, and bearing three to four long and well-filled pods omit a profuse bearer and very early. Berry small and white, with red spots near the eye. Two successive crops were made from seed obtained, the last maturing before last of August.

Lady Pea—A small vine and leaf, running moderately well. Bears a moderate crop of small white peas.

Unknown Pea—A large vine with an abundance of large leaves. Covers the ground very well, but with us gave a small crop of peas.

Large White—A smaller vine than the above but a better

runner. Has small leaves and bears a small crop of large white peas.

Whippoorwill—A coarse vine and a very poor runner, with large leaves. It bears a good crop of long pods containing large speckled peas.

Clay Pea—A small vined good-running pea, but a poor bearer of a yellowish pea, about the size of the Whippoorwill.

Conch Pea—A very heavy runner, forming a thick mat of vines all over the ground, but bearing few or no berries.

Of the above the Clay and Conch are decidedly the best—both for green manuring and for saving for hay. For the table the little Lady Pea seems to be preferred, while the Pea of the Backwoods gives decidedly the best yield of berries.

There were also a number of Mexican beans planted, but owing to the bad condition of the seed, which had been in the Agricultural Museum for some years, only one variety came up. This formed a very heavy vine and bore a profuse crop of small black beans. In the same plat with these beans were planted a few hills each of the Virginia, Georgia and Spanish Peanut. The Georgia did decidedly the best—both as regards the size and quantity.

Besides the above, seven plots of sugar cane were planted, six of which were fertilized and one left unfertilized, in order to find the results of fertilizer. Below is a table giving fertilizer per acre, yield per acre, percentage of Sucrose, Glucose, etc.

No.	Fertilizer per Acre.	Yield per acre, in tons.	Total solids.	Sucrose.	Glucose.	Purity co-efficient.	Glucose ratio.	Lbs. available sugar upon 70 p. c. extraction.	
								Per ton.	Per acre.
1	500 lbs. Cotton Seed Meal	28.48	17.70	15.00	.87	84.75	5.80	191.7	5459
2	500 lbs. Acid Phosphate	28.56	18.10	13.95	1.48	77.07	10.61	164.2	4689
3	500 lbs. Kainite	32.84	16.85	13.40	1.45	79.52	10.82	157.2	5162
4	Nothing	28.84	17.50	14.2	1.26	81.14	8.87	172.3	4969
5	500 lbs. Cotton Seed Meal 500 lbs. Kainite	28.32	17.55	15.2	.96	ȼ6.61	6.31	192.6	5454
6	500 lbs. Cotton Seed Meal 500 lbs. Acid Phosphate	27.28	17.80	14.8	.86	83.14	5.81	189.1	5159
7	500 lbs. Cotton Seed Meal 500 lbs. Acid Phosphate 500 lbs Kainite	27.08	18.35	16.0	.83	87.19	5.19	206.6	5595

These results are such that no decision as the increase of tonnage due to fertilizers can be drawn. No. 3 gave the largest tonnage and it would suggest at first the benefit of potash to this soil. Upon a closer examination, however, we find that No. 5, in which the same amount of potash again occurs actually falls below its neighbor, No. 4, which was unfertilized. Hence the increased yield cannot be ascribed to the fertilizer. The other results are so nearly identical that it may be said that commercial fertilizers for cane on this soil have this year yielded no increase in tonnage. There is, however, a large increase in sugar content in Nos. 7 and 5. Could the fertilizers have produced these desirable results?

SMALL GRAINS, GRASSES AND CLOVERS.

Early in 1888, roots of the *Texas Blue Grass* (Poa Arachnifera) were obtained from Mr. Carlos Reese, Marion, Ala., and planted in checks one foot apart each way. It made a vigorous growth during winter, seeded in May and died down to the ground. In September it reappeared in full vigor. It has now nearly occupied the entire ground and promises an excellent winter pasture. From this plat enough roots have been taken to plant a good size plat elsewhere and in a few years, if this plant fulfills its promise the Station will be able to furnish roots to the public. It is said to furnish an abundance of excellent green grass through the entire winter.

Para grass (Panicum Barbonode) was planted at same time upon an adjoining plat to the Texas Blue Grass. The roots were obtained from F. M. Hendry, Fort Myers, Fla. This is emphatically a summer grass, but with wonderful powers of growth. It has large stems which run along the ground, taking root at each joint and sending up simultaneously leaves and smaller stems. Some of these stems grew over twenty feet in length the first season. After it covers the ground its habits are said to change from the prostrate to the erect, and then furnishes a large amount of hay and pasturage. It is highly recommended and the Station is watching its development with interest.

In October, the Station planted five varieties of wheat, two

varieties of oats, two of barley, six of clovers and twelve of grasses. These are also growing finely and hopes are entertained of successful results.

EXPERIMENTS IN CORN.

This crop was planted with two objects: First, to ascertain the variety best suited to this soil and climate; second, to ascertain what fertilizers and in what quantities were needed by corn, on this land. All experiments in this direction were vitiated by depredations of both the cut and bud worm. In order therefore that we might not lose the experiment entirely, the number of stalks on each row were carefully counted and the results from each experiment accurately weighed. By ascertaining from this data the average yield per stalk, then allowing a stalk every two feet and multiplying by the number of stalks there should have been, we can form a fair idea of the yield of each. In order to answer the first question, eighteen varieties of corn were obtained and planted under the same conditions. Accompanying is a tabulated statement, giving names of varieties, yield, etc. Twelve ears of each were carefully weighed. These were shucked and weighed again. Then shelled and corn and cob weighed. In this way the per cent of corn, cob and shuck was obtained for each variety.

Name of Variety.	Yield per acre in pounds.	Per cent. shuck.	Per cent. cob.	Per cent. shelled corn.	Bushels shelled corn per acre.
Patterson	4648.62	8.	18.4	73.6	61.
Mosby	5481.72	6.	17.6	76.4	74.4
Blount	5068.96	8.6	16.7	74.7	79.6
Alabama	4894.8	10.9	18.9	70.2	61.3
McQuade	4356.2	8.9	17.1	74.0	57.5
White Normandy	2936.64	3.8	18.5	77.7	40.7
White Mexican	5184.92	10.9	16.2	72.9	67.4
Prolific	5236.2	10.	15.0	75.	70.1
New Madrid	4894.4	4.7	18.1	77.2	67.4
Red Cob Gourd Seed	4424.96	8.9	11.1	80.0	63.1
Champion	2524.48	7.3	14.2	78.5	35.3
New Hicory King	2590.72	8.0	12.	80.0	37.0
Mexican Flint	3716.16	7.8	15.3	76.9	51.0
Western Yellow	4452.8	11.	16.2	72.8	57.5
Mexican and Creole, Mixed	3521.76	14.4	16.0	69.6	43.7
Yellow Flint	4933.34	10.9	18.9	70.2	61.7
Yellow Golden	2838.75	14.8	20.5	64.7	32.7
Mixture of Red Cob and Mosby	3815.96	9.5	13.8	77.7	52.9

All of these were placed under similar conditions, but gave very varying results.

The Blount, with its 79.6 bushels of shelled corn, is in marked contrast with the Yellow Golden, with only 32.7. The foregoing table speaks for itself and renders any remarks superfluous.

The next attempt was to find out the manurial requirements of this soil.

These three questions on as many different plats were asked, both of corn and cotton:

1. "Does this soil need Phosphoric Acid? If so how much and in what form?"

2. "Does it need Potash? How much and in what form?"

3. "Does it need Nitrogen? How much and in what form?"

Question No. 1 was put to plat No. 10.

Twelve experiments with the various Phosphatic Manures were made, and the following table gives the fertilizers used with results:

PHOSPHORIC ACID—PLAT NO. X.

YIELD AND FERTILIZATION PER ACRE.

VARIETY USED—"PATTERSON."

No. of Exp't.	How Fertilized.	Shuck Corn, Lbs.	Shelled Corn, Bushels.
1	Basal Mixture* 280 lbs. Dissolved Bone	4168.28	54.7
2	Basal Mixture 560 lbs. Dissolved Bone	4639.96	60.9
3	Basal Mixture	4496.00	59.0
4	Basal Mixture 280 lbs. Acid Phosphate	4220.16	55.4
5	Basal Mixture 560 lbs. Acid Phosphate	4336.08	56.9
6	Basal Mixture	4396.00	57.7
7	Nothing	4176.76	54.8
8	Basal Mixture 280 lbs. Bone Meal	4483.92	58.9
9	Basal Mixture 560 lbs. Bone Meal	3396.00	44.6
10	Basal Mixture	4264.12	56.0
11	Basal Mixture 140 lbs. Gypsum	4439.96	58.3
12	Basal Mixture 280 lbs. Gypsum	4044.32	53.1

* Basal Mixture—2-0 lbs. Cotton Seed Meal.
84 lbs. Muriate Potash.

The results above lead to but one conclusion, and that is, that with this stand of corn, one stalk every two feet in the drill, that decaying roots of the old grass sod furnished an abundance of plant food to make a maximum crop. The unfertilized plat yielded 54.8 bushels, while the highest yield of any fertilized plat was only 60.9 bushels—differences that might occur in almost any two plats. Next year a repetition of these manures on the same plat may give more satisfactory replies.

In order to get the answer to Question 2, *i. e.*, Does this soil need potash, etc., we will examine:

PLAT IX—POTASH.

VARIETIES USED—"PATTERSON."

No. of Expe'm't.	How Fertilized.	YIELD PER ACRE. Shuck corn, lbs.	YIELD PER ACRE. Shelled corn, bus.
1	Meal Phosphate,* 168 lbs. Kainite	3956.4	51.9
2	Meal Phosphate 336 lbs. Kainite	5210.16	68.4
3	Meal Phosphate	4396.00	57.7
4	Meal Phosphate 42 lbs. Muriate Potash	4572.84	60.1
5	Meal Phosphate 84 lbs. Muriate Potash	4264.12	56.0
6	Meal Phosphate	3122.24	41.1
7	Nothing	3648.68	47.9
8	Meal Phosphate 42 lbs. Sulphate Potash	4396.00	57.7
9	Meal Phosphate 84 lbs. Sulphate Potash	4396.00	57.7
10	Meal Phosphate	4483.92	58.9
11	280 lbs. Acid Phosphate 196 lbs. Cotton Seed Meal 49 lbs. Nitrate Potash	4439.96	58.3
12	280 lbs. Acid Phosphate 84 lbs. Cotton Seed Meal 98 lbs. Nitrate Potash	4220.16	55.4

* Meal Phosphate—280 lbs. Cotton Seed Meal.
280 lbs. Acid Phosphate.

The remarks under Plat 10 are applicable here as under Plat XI., soon to follow.

PLAT XI.—NITROGEN.

VARIETY—PATTERSON.

No. of Exp't.	Fertilizer Used.	YIELD PER ACRE. Shuck corn, lbs.	Shelled corn, bus.
1	Mixed Minerals* .... 79.8 lbs. Nitrate Soda	4396.	57.7
2	Mixed Minerals .... 158.6 lbs. Nitrate Soda	5055.4	66.4
3	Mixed Minerals .... 53.2 lbs. Sulphate Ammonia	4396.	57.7
4	Mixed Minerals .... 106.4 lbs. Sulphate Ammonia........	4068.08	53.4
5	Mixed Minerals .... 112 lbs. Dried Blood	4396.0	57.7
6	Mixed Minerals .... 224 lbs. Dried Blood	4689.72	61.
7	Mixed Minerals .... 140 lbs. Fish Scrap	4689.72	61.
8	Mixed Minerals .... 280 lbs. Fish Scrap	4068.08	53.4
9	Mixed Minerals .... 168 lbs. Cotton Seed Meal........	4747.68	62.3
10	Mixed Minerals........ 336 lbs. Cotton Seed Meal	4255.4	56.0
11	Mixed Minerals .... 504 lbs. Cotton Seed........	4396.0	57.7
12	Mixed Minerals .... 1008 lbs. Cotton Seed	4396.0	57.7

* Mixed Minerals—280 lbs. Acid Phosphate.
84 lbs. Muriate Potash.

It is to be regretted that no conclusions can this year be derived as to the wants of this soil for corn growing. Another and perhaps even another year may be needed to satisfactorily solve this question. In meanwhile the experiments will be continued.

EXPERIMENTS IN COTTON.

The experiments in cotton were of two kinds. 1st. Varieties best adapted to our wants, considering yield of seed cotton, and percentage of lint; and 2d, Manurial requirements. Thirty-eight varieties of cotton, obtained at great labor and cost, were planted and treated as nearly alike as possible. These experiments, together with those elsewhere described, were growing beautifully with promise of large results when the disastrous storm of the 19th August, not only injured but absolutely destroyed them. Many of the full grown bolls nearing maturity, which would otherwise have opened, were completely rotted by the two weeks of incessant rains following the storm. Therefore all of our experiments in cotton were failures so far as instruction is concerned.

Below is a table giving the yield of seed cotton and of lint per acre, together with the percentage of lint.

VARIETIES OF COTTON.

Name of Variety.	Seed Cotton, Lbs.	Lint, Lbs.	Percentage of Lint.	Remarks.
Southern Hope	950	323.	34.	
Bancroft's Herlong	1140	353.4	31.	
Petit Gulf	646	187.3	29.	
Allen's Long Staple	912	310.	34.	
Tennessee Silk	798	215.4	27.	
Boyd's Prolific	798	223.4	28.	
Peterkin	570	199.5	35.	
Crawford	836	259.16	31.	
Hawkins	836	265.52	32.	
Peerless	874	270.9	31.	
Dickson's	696	215.7	31.	
Welborn's Pet	696	......	...	
King's Improved	870	304.5	35.	
Hawkins	608	176.3	29.	
Peterkin	870	304.5	35.	Home raised seed.
Oat's Cotton	760	250.8	33.	Selected seed.
Little Brannon	760	304.0	40.	Home raised seed.
Allen's Long Staple	722	187.7	26.	" " "
Boyd's Prolific	798	231.42	29.	" " "
Peterkin	684	205.2	30.	" " "
Tennessee Silk	798	255.16	32.	" " "
Martin's Prolific	779	233.7	30.	" " "
Herlong	646	206.72	32.	" " "
Jones' Improved	870	261.00	30.	" " "
Jower's Improved	608	176.32	29.	" " "
Cherry's Long Staple	608	176.32	29.	" " "
Shine's Early	570	176.7	31.	" " "
Jower's Improved	646	......	...	Second year seed.
Cherry's Long Staple	532	205.84	37.	" " "
S. B. Maxey	608	176.32	29.	" " "
Shine's Early	779	233.7	30.	" " "
Griffin's Improved	722	194.94	27.	" " "
Taylor's Improved	874	270.9	31.	" " "
Bancroft's Herlong	456	123.12	27.	" " "
Pure Brannon	304	......	...	

Besides the above, a plat of "Sea Island" was also planted. This had not begun to mature when the storm killed it outright. These cottons were carefully ginned on an improved twenty-saw gullett gin, with feeder and condenser, made especially to order for this Station. Each variety was weighed into the gin, and seed and lint weighed after.

MANURES FOR COTTON.

Three plats of cane for Nitrogen, one for Potash and one for Phosphoric Acid were devoted to experiments in fertilizing cotton—seeking simliar answers to those propounded with corn.

PLAT NO. 12—NITROGEN.

VARIETY OF SEED USED—PETERKIN.

No of Experim'nt.	Fertilizer Per Acre.	Yield of Seed Cotton per acre, lbs.	Yield of lint per acre, lbs.
1	Mixed Minerals * 79.8 lbs. Nitrate Soda	952.	333.2
2	Mixed Minerals 159 6 lbs. Nitrate Soda	862.	301.7
3	Mixed Minerals 53.2 lbs. Sulphate Ammonia	812.	284.2
4	Mixed Minerals 106.4 lbs. Sulphate Ammonia	644.	225.4
5	Mixed Minerals	742.	259.7
6	Nothing	504.	176.4
7	Mixed Minerals 112 lbs. Dried Blood	728.	254.8
8	Mixed Minerals 224 lbs. Dried Blood	756.	264.6
9	Mixed Minerals 140 lbs. Fish Scrap	742.	259.7
10	Mixed Minerals 280 lbs. Fish Scrap	728.	254.8
11	Mixed Minerals	714.	249.9
12	Nothing	504.	176.4
13	Mixed Minerals 168 lbs. Cotton Seed Meal	756.	264.6
14	Mixed Minerals 336 lbs. Cotton Seed Meal	770.	269.5
15	Mixed Minerals 504 lbs. Cotton Seed	700.	285.
16	Mixed Minerals 1008 lbs. Cotton Seed	602.	210.7
17	Mixed Minerals	560.	196.0
18	Nothing	344.4	120.5

* Mixed Minerals—280 lbs. Acid Phosphate.
84 lbs. Muriate Potash.

In this experiment an attempt was made to find out whether this soil needed Nitrogen to grow cotton? If so, in what form and in what quantity? Nitrate Soda, Sulphate Ammonia, Dried Blood, Fish Scrap, Cotton Seed Meal and Cotton Seed were used to furnish the Nitrogen and each used in such quantities as to furnish respectively 12 and 24 lbs. Nitrogen per acre. Along with them, and without them at periodical distances, we used Mixed Minerals—a mixture of Acid Phosphate and Nitrate of

Potash. The results of these experiments upon their face answer the question that this soil perhaps needs Nitrogen for cotton—since by comparing the experiments with Nitrogen with those without (Mixed Minerals) and there is found in nearly every instance a notable increase. The increase of the Mixed Minerals over the unfertilized plats would indicate their need too. But it must be remembered, that one of the beneficial effects of commercial fertilizers is to hasten the maturity of cotton. After the storm of 10th August, both growth and maturiation were destroyed, and only those bolls which had reached maturity at that date were ever picked. What would have been the results had no disaster intervened is a matter of conjecture only. Perhaps the unfertilized cotton might have, towards close of season, caught up with that fertilized, and perhaps on the other hand, with favorable seasons the fertilized cotton, having received such a vigorous impetus in early growth, might have developed into an enormous crop, greatly enhancing the disproportion which existed between it and that unfertilized at the time of the storm. The storm transferred all this to the realm of speculation and left us with doubtful facts upon which we can have opinions but cannot make accurate scientific deductions.

Plat XIII. was devoted to experiments with phosphates under cotton.

PLAT XIII.—PHOSPHORIC ACID.

VARIETY—PETERKIN.

No. of Experim'nt.	Fertilizer per Acre.	Yield of Seed Cotton per acre, lbs.	Yield of Lint per acre, lbs.
1	Basal Mixture* 280 lbs. Dissolved Bone	854	298.9
2	Basal Mixture 560 lbs. Dissolved Bone	1078	337.4
3	Basal Mixture 280 lbs. Acid Phosphate	882	308.7
4	Basal Mixture 560 lbs. Acid Phosphate	910	318.5
5	Basal Mixture	812	284.2
6	Nothing	560	196.0
7	Basal Mixture 280 lbs. Precipitated Dissolved Bone	784	274.4
8	Basal Mixture 560 lbs Precipitated Dissolved Bone	644	225.4
9	Basal Mixture 280 lbs. Precipitated Acid Phosphate	686	240.1
10	Basal Mixture 560 lbs. Precipitated Acid Phosphate	560	196.
11	Basal Mixture	658	230.3
12	Nothing	588	205.8
13	Basal Mixture 280 lbs. Bone Meal	686	240.1
14	Basal Mixture 560 lbs. Bone Meal	748	251.8
15	Basal Mixture 140 lbs. Gypsum	560	196.
16	Basal Mixture 280 lbs. Gypsum	658	230.3
17	Basal Mixture	658	230.3
18	Nothing	487	170.45

* Basal Mixture—280 lbs. Cotton Seed Meal.
84 lbs. Muriate of Potash.

Here again phosphates of all kind, particularly those of a soluble character, have given increased yields; but the same objection of drawing conclusions exist here as under Plat 12, and it is best to await another trial before forming an opinion.

Plat No. 14 is devoted to experiments with different forms and quantities of Potash—asking same questions for cotton as has been asked under corn.

PLAT 14—POTASH.

VARIETY OF SEED—BOYD'S PROLIFIC.

No. of Experim'nt.	Fertilizer Per Acre.	Yield of Seed Cotton per acre, lbs	Yield of lint per acre, lbs.
1	Meal Phosphate* 168 lbs. Kainite	1022	296.38
2	Meal Phosphate 336 lbs. Kainite	840	243.6
3	Meal Phosphate 42 lbs. Muriate Potash	868	251.72
4	Meal Phosphate 84 lbs. Muriate Potash	910	263.9
5	Meal Phosphate	756	219.24
6	Nothing	700	203.
7	Meal Phosphate 42 lbs. Sulphate Potash	826	239.5
8	Meal Phosphate 84 lbs. Sulphate Potash	644	186.76
9	196 lbs. Cotton Seed Meal 280 lbs. Acid Phosphate 49 lbs. Nitrate Potash	700	203.
10	84 lbs. Cotton Seed Meal 280 lbs. Acid Phosphate 98 lbs. Nitrate Potash	854	247.66
11	Meal Phosphate	770	223.3
12	Nothing	554	160.66

* Meal Phosphate—280 lbs. Acid Phosphate.
280 lbs. Cotton Seed Meal.

Remarks upon the above experiments are unnecessary. In fact no experiments with cotton this year on this Station are deemed of value. The disastrous storm of the 19th August, unprecedented in its fury and effects, destroyed in a night the cherished hopes and longing anticipations of months. All these experiments germinated well and excellent stands were obtained. The cultivation was very satisfactory and up to the storm the entire crop gave promise of the most decisive results. In a night all were destroyed and expectations of results postponed to another year.

Besides the foregoing work the Station has also undertaken an experiment in rotating a field with Cotton, Corn, Oats and Peas. For this purpose eight acres were accurately laid off,

with roads between each one. Two acres are devoted to each crop, one fertilized yearly and the other unfertilized. Of course, several years will elapse before any results can be obtained.

In closing this report it would be well to say that this Station sees no reason for changing the formulas for corn and cotton published heretofore in its bulletins, and in reply to the numerous inquiries from planters and farmers will here repeat those for cotton, found heretofore so efficacious:

700 ℔s. Cotton Seed Meal.
1100 ℔s. Acid Phosphate.
200 ℔s. Kainite.

Mix thoroughly and apply in a shovel furrow before planting, taking care to mix well with soil, by running a bull tongue through it after distribution. From 200 to 500 pounds per acre are quantities usually recommended. If Cotton Seed is on hand it may be profitably made into a compost, with stable or lot manure and Acid Phosphate, in following proportions:

100 bushels Cotton Seed.
100 " Manure.
1 ton Acid Phosphate.

For sandy land 1000 ℔s. Kainite may be advantageously added. Mix well this compost before use and apply from 300 to 1000 ℔s. per acre in drill before planting.

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ANNUAL REPORT

OF THE

NORTH LOUISIANA EXPERIMENT STATION,

CALHOUN, LA.

BULLETIN NO. 22.

WM. C. STUBBS, A. M., Ph. D., Director.

—ISSUED BY—

THOMPSON J. BIRD,

COMMISSIONER OF AGRICULTURE, BATON ROUGE, LA.

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NORTH LOUISIANA EXPERIMENT STATION,
CALHOUN, LA., January, 1889.

Major T. J. Bird, Commissioner of Agriculture, Baton Rouge, La.:

Dear Sir—I hand you herewith a report of Experiments conducted on this Station for the year 1888, and ask that you publish it as Bulletin No. 22.

Respectfully submitted,

WM. C. STUBBS, Director.

REPORT.

On the 6th day of April there was turned over to the Louisiana State University and Agricultural and Mechanical College a tract of land containing 330 acres in Ouachita parish, fourteen miles west of Monroe, lying immediately on the Vicksburg, Shreveport and Pacific Railroad, and near the village of Calhoun. This tract was without fences or houses of any kind. A portion of the land was cleared and had been considerably worn by constant cultivation, it is said, of seventy-five years. Another portion had once been cleared, but was now covered with a growth of short leaf pines, averaging over 1 foot in diameter. A third and larger portion was covered with the original timber, oak, hickory and pine. At this late day it seemed almost impossible to accomplish anything the first year. But, securing the services of Mr. L. M. Calhoun as manager, an attempt was made, and the results which follow will show the great success which he achieved. By his indomitable energy and intelligent direction the place was gradually transformed into a Station of considerable attractiveness. Substantial fences of wire and plank were soon erected. Fifty acres of "old fields" were brought under cultivation, of which thirty were planted in field crops and twenty devoted to experiments. Contracts were made for the erection of the necessary buildings, over fifty acres of wooded land were cleared; cross fences, dividing the lands into fields for tillage and pasture, were erected. A garden of nearly one acre in size was paled in, large gullies were filled in and unsightly inequalities removed. Such was some of the work performed in '88. The dawn of '89 illuminated an entirely different scene from that which was presented to us in April, 1888—a scene which now remains only in memory as the horrid nightmare that haunted us in "dream and wake" during this eventful spring and summer.

The station is now equipped with dwellings, barns, stables and laboratory. It is completely and securely enclosed. It is divided into tillage and pasture, orchards and gardens, woodland and meadow. Thirty acres of the oldest land on the place have been carefully platted, and will be devoted permanently to field experiments in manure with various crops. Another field of twenty acres has been devoted to experiments in small grain, grasses and clovers. Ten acres have been dedicated to orchards, vineyard and garden. Fifty acres to general field crops, and the rest divided into pastures for different breeds of stock. Of the latter, two of the improved breeds of cattle have already been obtained, a pair each of Holsteins and Jerseys—the former from Mr. J. W. Howard, Aberdeen, Miss., and the latter from Dr. William E. Oates, of Vicksburg, Miss. The Holsteins are lineal descendants of the celebrated Aggie family, while the Jerseys are of the famous St. Lambert strain. Two other breeds will be added as soon as our resources will permit. Of hogs, the Berkshire, Essex, Red Durocs and White Chesters have been engaged, and will be received early in the spring. Four varieties of sheep will also be introduced. Later, it may be advisable to introduce one or more breeds of horses, since this portion of Louisiana is specially adapted to horse and mule raising. In the introduction of improved breeds of stock, the Station aims to benefit this portion of Louisiana by determining which kinds are best adapted to this section, and, further, to give practical lessons in the principles which underlies stock feeding and stock breeding.

In a lot specially dedicated to the purpose, sixteen neat web wire yards, 30x60 feet, with neat and substantial houses, have been erected for different kinds of poultry. The following improved breeds have already been obtained and are doing finely, viz., Langshans, Black Minorcas, Wyandottes, Brown Leghorns, Barred and White Plymouth Rock, Buff and Partridge Cochins, Houdans and Light Brahmas of chickens, and the Pekin duck.

A trio of each have been obtained, and each variety are treated precisely alike. A careful daily record of the eggs laid by each variety is kept, together with such other characteristics

as are worthy of note, and at the end of the season will be published for the benefit of the public. Later, this supply of poultry will be increased by addition of other varieties, including turkeys and geese.

This Station has been established in the hills of North Louisiana for the purpose primarily of benefitting the farmers of that section. That it has awakened an enthusiasm among the latter is evident from the large monthly meetings which are held the last Thursday in every month on the grounds of this Station. The V. S. & P. Railroad has liberally contributed to this movement by running excursion trains on the day of meeting from Vicksburg and Shreveport—thus giving the farmers at a reduced cost, not only an opportunity of visiting and inspecting the work of the Station, but also of enjoying the benefits of the discussions of the practical questions by the best farmers of North Louisiana, which this club monthly affords. This club is called "The North Louisiana Agricultural Society," and is ably presided over by Capt. J. M. White, of Lincoln parish. Its Secretary is Mr. L. C. Drew, of Calhoun, La. This club entertained with a fine barbecue the State Agricultural Society, which recently held its annual meeting in Monroe. It has also undertaken to build a large hall on the Station, in which to hold its monthly meetings, and has appointed the necessary committees on subscription and building. In a few months, it is hoped, the hall will be completed, and will be ample in its accommodations for the large number which monthly attend these meetings.

At no time does the Station contemplate keeping more live stock than will answer the purposes of experimentation. It is, therefore, proposed at each meeting of this society to sell its surplus at auction, thus giving the farmers an opportunity of buying at their own figures. Besides the above, the males of all breeds will be permitted to serve a limited number of females at prices fixed upon by a committee appointed by the above mentioned society. Arrangements have accordingly been made to take care of all animals thus sent.

Early in the winter two trees of each of the following were carefully planted. They were obtained from the old and reliable nursery of P. J. Berckmans, Augusta, Ga.:

FIGS—10 Varieties.

Lemon.	Angelique.	Madeline.
Green Ischia.	Black Ischia.	Blue Genoa.
Brunswick.	Brown Turkey.	White Marseilles.
	Celestial.	

FILBERTS—1 Variety.

White Filbert.

ALMONDS—4 Varieties.

Pistache.	Standard.	Princess.	Sultana.

QUINCES—6 Varieties.

Rae's Mammoth.	Portugal.	Meech's.
Angers.	Chinese.	Orange.
	Champion.	

APRICOTS—15 Varieties.

Jamucett.	Early Golden.	G. De Pourtales.
J. T. Budd.	Moorpark.	St. Ambrose.
Black.	Red Roman.	Finney.
Jackson.	Royal.	Precoce de Bourbon.
Luizet.	Breda.	Eureka.

NECTARINES—8 Varieties.

Stanwix.	Early Violet.	Boston.
Coosa Neck.	Duc de Tellier.	New White.
Golden Cling.	Victoria.	

CHESTNUTS—3 Varieties.

Japan.	Large Spanish.	American.

JAPANESE PERSIMMONS—10 Varieties.

Kurokume.	Yellow Japanese.	Ko. Tsuru.
Minokaki.	Hyakume.	Costata.
Zingi.	Hacheya.	Mazelli.
	Among.	

PLUMS—16 [illegible]

Newman's.	Pottowattamie	[illegible]pper's Pride.
Miners.	Kanawha.	[illegible]nus Simoni.
Robinson's.	Cumberland.	Marianna
Masu.	Wild Goose.	De Caradeuc.
Kelsey's Japan.	Botan Japan.	Chabot's Japan.
	Long Fruited Japan.	

PEARS—Dwarf and Standard—34 Varieties.

Belle Lucrative (S)	Beurre Langelier (F)	Beurre Giffard (S)
Beurre Easter (F)	Beurre Diel (F)	Beurre Superfine (F)
Beurre D'Anjou (F)	Duchess D'Angouleme (F)	Buffon (S)

Daimio (H)	Garbers (H)	Bartlett (S)
Lawson (S)	Smith (H)	Mikado (H)
St. Michael Archangel (F)	Urbaniste (S)	Philadelphia (S)
Petite Marguerite (S)	Glout Morceau (F)	Hebe (F)
Stevens' Genesee (S)	St. Martin,	Ott (S)
Le Conte (H)	Keiffer (H)	Onondaga (F)
Clapp's Favorite (S)	Howell (S)	Seckel (S)
Madame Von Siebold (H)	Osband's Summer (S)	Winter Nellis (F)
	Doyenne D'Ete (S)	

(S) Summer. (H) Hybrid. (F) Fall.

PEACHES—Freestone and Cling—32 Varieties.

Alexander,	Early Crawford,	Early Rivers,
Early Beatrice,	Early Hale,	Early Louise,
Crawford's Late (C)	Heath Late,	Amelia,
Haney,	Oriole,	Pineapple (C)
Stonewall Jackson (C)	Tinsley's October (C)	Thurber,
Indian Blood,	Columbia,	Elberta,
Juno (C)	Pallas,	Osceola,
Picquet's Late,	Old Mixon Cling (C)	Newington Cling (C)
Stump the World,	Darby's Cling (C)	Fleitas,
Cora,	Gen Lee (C)	Stevens' Rareripe,
Reeve's Favorite,	Sylphide (C)	

(C) are clingstones, the rest are open or free.

APPLES—40 Varieties.

Red Astrachan (S)	Summer Queen (S)	Yopp's Favorite (F)
Wallace Howard (F)	Stevenson's Winter (W)	Etowah (W)
Jewett's Best (S)	Pear or Palmer (S)	Mama (F)
Hoover (F)	Elgin Pippin,	Carolina Greening (F)
Maverack's Sweet (W)	Early Red Margaret (S)	Carter's Blue (F)
Cannon Pearmain (W)	Horse (S)	Hackett's Sweet (W)
Tuscaloosa (F)	Shockley (W)	Shannon (F)
Carolina Watson (S)	Hilley's Eureka (W)	Lanier (F)
Santa (W)	Chattahoochee (W)	Simmons Red (F)
Moultrie (W)	Black Warrior (W)	Disharoon (F)
Rhodes Orange (S)	Harvest (S)	Romanite (W)
Buncombe (F)	Washington Strawberry (S)	Kittageskee (W)
Wine Sap (W)	Howe (W)	Mangum (W)
	Ben Davis (W)	

(S) Summer apple. (F) Fall Apple. (W) Winter Apple.

GRAPES—56 Varieties.

Salem.	Roger's No. 8.	Missouri Riesling.
Rulander.	" " 31.	Transparent.
Massasoit.	" " 37.	Alvey.
Merrimac.	" " 39.	Highland.
Herbert.	Anadna.	Irving.
Berckman's.	Othello.	Grein's No. 31.
Concord.	Lady Washington.	" " 53.
Blue Sar[illegible]	[illegible]e.	" " 4.
Welcome.	[illegible]	Allen's Hybrid.
Telegraph	[illegible]	Diana.
Miles.	[illegible]agara.	Amber.
Wilde.	[illegible]aith.	Norton's Virginia.
Lindle.	Black July.	Gœthe.
Fanny	Emily.	Excelsior.
Peabody.	Herbert.	Brighton.
Maxatawney.	Black Eagle.	Iona.
Martha.	Canada.	Black Hamburg.
Mrs. McLane.	Louisiana.	Belinda.
Black Pearl.	Eumelan.	

To the above must be added twenty-six varieties of strawberries shipped from Baton Rouge.

These have all been carefully planted and fertilized, and special attention will be given them in the future.

SMALL GRASSES AND CLOVERS.

A special area has been devoted to experiments in the above crops.

There were planted last fall experiments in varieties of Wheat, Oats, Barley and Rye. There are also experiments in manurial requirements of the soil with Oats and Barley. All of these are at present writing doing well and promise good results.

The following Clovers have been sown during the fall:

Red Clover,	White Clover,	Crimson Clover,
Alsyke Clover,	Bokhara Clover,	Lucerne.

It is too early yet even to venture an opinion as to the results.

Of Grasses there were planted:

Texas Blue Grass,	Kentucky Blue Grass,
Para Grass,	Orchard Grass,
Red Top Grass,	Timothy Grass,
Tall Meadow Oat Grass,	Rescue Grass,
Soft Broom Grass,	Randall Grass,
Tall Fescue Grass,	Velvet Grass,
Italian Rye Grass,	English Rye Grass.

The Rescue seed failed to germinate—the rest have given stands varying from excellent to poor. They have been top-dressed with a suitable manure and will be watched carefully during the ensuing year.

THE GARDEN

has been prepared for the reception of vegetables at once, and the seed of all the varieties procured. It is designed to test the varieties of each kind, and as far as possible to develop the truck industry, both for home use and for market.

FIELD EXPERIMENTS.

Last year about twenty acres were devoted to experiments in crops, testing varieties and manures best adapted to this soil for the different crops. This area was divided into 15 Plats. Plats I., III., V., VI., VIII., were devoted to Cotton. Plats II., IV., VII., IX. and XVII. to Corn. Plat X. to Forage Crops. Plat XI. to Sorghums. Plat XII. to Sundry Crops. Plat XIII. to Cow Peas and Plat XV. to Watermelons.

EXPERIMENTS IN COTTON.

PLAT NOS. I AND III.

These plats were selected, No. I. on the sandy land and No. III. on the red lands. They are of same size.

They were divided into forty experiments of three rows each, and the manures applied in the form and quantity per acre designated below. The rows were 3½ feet apart. The manures were mixed and put out April 11th in a shovel furrow, then bedded on and middles split out. The beds were then harrowed flat, opened and seed planted April 14th. Variety used—Peterkin. The seed were covered with harrow and board. They were chopped out, leaving one stalk to a hill every hoe chop. May 14th and 17th, offbarred with half-shovel May 7th; after cultivation with scooter and scrape. The land was very poor, containing little or no vegetable matter. Each plat was picked four times. The following shows manures used and quantity of each, date of picking and total per acre:

RESULTS OF PLATS I. AND III.—COTTON WITH DIFFERENT MANURES.

No. of Exp't.	Kind and Quantity of the Manure Used, per Acre.	1st Picking Aug. 27.		2nd Picking Sept. 3.		3rd Picking Oct. 2.		4th Picking Nov. 24.		Total Yield per Acre. Plat I.	Total Yield per Acre. Plat III.
		Plat I.	Plat III.	Plat I.	Plat III.	Plat I.	Plat III.	Plat I.	Plat III.		
1	No Manure	00	120	240	160	260	240	90	60	590 lbs.	580 lbs.
2	200 lbs. Cotton Seed Meal	240	240	360	240	280	180	80	40	960	780
3	200 lbs. Acid Phosphate	80	120	320	180	340	200	60	80	800	580
4	200 lbs. Kainite	40	120	200	180	320	240	200	40	740	580
5	{ 200 lbs. Cotton Seed Meal { 200 lbs. Kainite	160	320	440	240	360	160	80	20	1040	740
6	{ 200 lbs. Cotton Seed Meal { 200 lbs. Acid Phosphate	280	400	540	240	300	120	60	40	1180	800
7	{ 200 lbs. Acid Phosphate { 200 lbs. Kainite	80	120	360	200	420	220	120	40	980	580
8	{ 200 lbs. Cotton Seed Meal { 200 lbs. Acid Phosphate } In drill. { 200 lbs. Kainite	240	400	580	240	320	140	60	30	1200	810
9	Same as 8. Broadcast	200	200	480	240	380	200	80	40	1140	680
10	No Manure	160	80	380	180	480	260	40	80	1060	600
11	300 lbs. Cotton Seed Meal	280	320	460	280	360	220	60	60	1160	880
12	{ 300 lbs. Cotton Seed Meal { 300 lbs. Acid Phosphate	480	406	560	280	280	160	60	60	1380	900
13	{ 300 lbs. Cotton Seed Meal { 300 lbs. Acid Phosphate } In drill. { 300 lbs. Kainite	360	440	500	300	300	140	40	20	1200	900
14	Same as 13. Broadcast	240	280	440	260	360	180	160	40	1200	760
15	400 lbs. Cotton Seed Meal	360	400	500	320	300	140	120	20	1280	880
16	{ 400 lbs. Cotton Seed Meal { 400 lbs. Acid Phosphate	600	480	540	300	180	120	50	20	1370	920
17	{ 400 lbs. Cotton Seed Meal { 400 lbs. Acid Phosphate } In drill. { 400 lbs. Kainite	480	600	520	320	160	120	130	20	1290	1060
18	Same as 17. Broadcast	280	400	480	280	240	180	60	40	1060	900
19	{ 400 lbs. Acid Phosphate { 200 lbs. Kainite	80	120	320	200	280	260	120	70	800	650
20	No Manure	40	80	120	208	280	220	120	80	560	580
21	{ 400 lbs. Cotton Seed Meal { 200 lbs. Acid Phosphate	480	640	320	360	160	120	60	20	1020	1140

RESULTS OF PLATS I. AND III.—COTTON WITH DIFFERENT MANURES.—*Continued.*

No. of Exp't.	Kind and Quantity of the Manure Used, Per Acre.	1st Picking Aug 27.		2nd Picking Sept. 3.		3rd Picking Oct. 2.		4th Picking Nov. 24.		Total Yield per Acre.	Total Yield per Acre.
		Plat I.	P III.	Plat I.	Plat III.	Plat I.	Plat III.	Plat I	Plat III.	Plat I.	Plat III.
22	400 lbs. Cotton Seed Meal; 200 lbs. Acid Phosphate; 200 lbs. Kainite — In drill.	520	560	280	360	120	100	30	40	950 lbs.	1060 lbs.
23	Same as 22. Broadcast.	480	400	280	320	100	160	30	40	900	920
24	200 lbs. Cotton Seed Meal; 400 lbs. Acid Phosphate	440	480	200	300	100	140	20	30	760	950
25	200 lbs Cotton Seed Meal; 400 lbs. Acid Phosphate; 200 lbs. Kainite — In drill.	400	520	320	300	100	140	30	20	850	980
26	Same as 25. Broadcast.	440	400	240	320	100	180	20	40	800	940
27	400 lbs. Acid Phosphate.	80	200	160	240	220	220	100	50	560	710
28	400 lbs. Kainite.	40	100	140	200	220	220	140	50	540	630
29	400 lbs. Acid Phosphate; 400 lbs Kainite	80	240	160	280	260	200	140	40	640	820
30	No Manure.	20	80	60	160	180	264	160	70	420	570
31	600 lbs Cotton Seed.	80	360	180	240	260	230	160	50	680	890
32	600 lbs. Cotton Seed; 200 lbs. Acid Phosphate	240	320	280	300	260	220	160	40	940	880
33	600 lbs. Cotton Seed; 200 lbs. Acid Phosphate; 200 lbs. Kainite	360	280	260	300	240	240	100	40	960	860
34	900 lbs. Cotton Seed.	240	280	220	300	260	180	100	30	820	790
35	900 lbs. Cotton Seed; 300 lbs. Acid Phosphate	360	360	320	300	180	160	140	20	1000	840
36	900 lbs. Cotton Seed; 300 lbs. Acid Phosphate; 200 lbs. Kainite.	380	400	280	300	220	180	140	30	1020	910
37	1200 lbs. Cotton Seed	360	320	80	320	220	180	260	30	920	850
38	1200 lbs. Cotton Seed; 400 lbs. Acid Phosphate	520	400	300	320	180	180	60	20	1060	920
39	1200 lb. Cotton Seed; 400 lbs. Acid Phosphate; 200 lbs. Kainite	440	400	320	340	200	180	60	20	1020	940
40	No Manure.	240	80	200	160	180	180	40	20	660	480

THE QUESTIONS PROPOUNDED OF THIS PLAT

are of three kinds. 1st. What valuable ingredients of fertilizers is this soil in need to grow cotton? 2d. In what proportions shall these be combined? 3d. Shall it be distributed broadcast or in the drill? The three valuable ingredients of all fertilizers are Nitrogen (Ammonia), Phosphoric Acid and Potash. Cotton Seed Meal and Cotton Seed have been used to supply the Nitrogen. The former containing about 7 per cent and the latter 2½ per cent of this ingredient; Acid Phosphate, containing 14 per cent Soluble Phosphoric Acid; and Kainite, containing 12 per cent of Potash have been used as the sources of Phosphoric Acid and Potash. These substances have been used alone and combined in various proportions and quantities, and every tenth experiment has been left unfertilized, so as to get at the average strength of the land experimented with.

Another question has been incidentally asked, which is best source of Nitrogen, Cotton Seed Meal or Cotton Seed? Unfortunately these seed having been exposed out of doors for some months before using, were thoroughly dead and to what extent they had lost their fertillzing properties was not determined. By comparing each experiment with its nearest unmatured plat, the increase due to manure can be obtained.

In Plat I., beginning with Experiment 3 and extending to about Experiment 17 was a patch of Bermuda Grass, which had greatly influenced the results. Experiment No. 10, which occurred in this patch and which is unmanured, gave a yield of 1060 lbs. per acre. Even here, however, the manures clearly show an increase depending entirely upon the kinds used. If we eliminate Experiment 10 of Plat I., we will find that the averages of the other unfertilized experiments are 559 lbs. for Plat I. and 562 lbs. for Plat III., which, about represents the average strength of the field.

Tabulating the results as we find them, we have:

	Plat I.	Plat III.
Average of all unfertilized Exp'ts Nos. 1, 10, 20, 30 and 40	658 lbs.	562 lbs.
" " Acid Phos. " " 3 and 27	680 "	645 "
" " Kainite " " 4 and 28	640 "	605 "
" " C. S. Meal " " 2, 11 and 15	1133 "	846 "
Average of Acid Phosphate and Cotton Seed Meal, Experiments Nos. 6, 12 and 16	1263 "	853 "
Average of all Acid Phosphate and Cotton Seed Meal, Experiments Nos 6, 12, 16, 21 and 24	1036 "	926 "
Average of Cotton Seed Meal and Phosphate and Kainite (in drill), Nos. 8, 13 and 17	1230 "	923 "
Average of all Cotton Seed Meal and Phosphate and Kainite (in drill), Nos. 8, 13, 17, 22 and 25	1098 "	962 "

	Plat I.	Plat II
Average of Cotton Seed Meal and Phosphate and Kainite (broadcast) Nos. 9, 14 and 18	1133 "	826 "
Average of all Cotton Seed Meal and Phosphate and Kainite (broadcast) Nos. 9, 14, 18, 23 and 26	1020 "	840 "
Average of Cotton Seed, Nos. 31, 34 and 37	806 "	843 "
Average of Cotton Seed and Acid Phosphate, Nos. 32, 35 and 38	953 "	856 "
Average of Cotton Seed and Acid Phosphate and Kainite, Nos. 33, 36 and 39	1006 "	873 "
Average of Cotton Seed Meal and Kainite, No. 5	1040 "	740 "

From the above there is no doubt that this soil needs first, Nitrogen (very badly); and second, Phosphoric Acid, and perhaps Kainite in small quantities may be beneficial. In Plat I. it must not not be forgotten that our Bermuda grass patch has altered largely our average results, and we must compare each experiment with its nearest unfertilized plat to get at its true increase. It is further shown that this soil did not profit by large quantities of any ingredient and was perhaps unable to appropriate such large doses in its present enfeebled condition. It was also imperfectly and hastily prepared and in no way fit to receive heavy fertilization. These experiments also show that both Cotton Seed Meal and Cotton Seed are capable of supplying the plant abundantly with Nitrogen. For soils similar to these a combination of Cotton Seed Meal and Acid Phosphate, varying in proportion from equal parts to one of former to two of the latter and used in quantities from 200—500 lbs. per acre seems to be admirably adapted. If the soil contained a fair amount of vegetable matter, one of Cotton Seed Meal to two of Acid Phosphate can best serve it. If it be deficient in vegetable matter, then equal parts had better be applied. In both instances where soil is very sandy a small amount of Kainite had better be added. In almost every instance the fertilizers applied in the drill have produced superior results to those broadcast.

PLAT NO. V.—COTTON.

Object—To determine best distance in width of rows for cotton on this soil. The plat was broken broadcast and 150 lbs. of a mixture consisting of two parts Cotton Seed Meal, 2 parts Acid Phosphate and one part of Kainite, was carefully sown broadcast over the entire plat. It was then carefully laid off into rows varying in width from 2½ to 6 feet wide, giving three rows to each experiment. The rows were exactly one-half acre in length. It was planted in Peterkin cotton, April 17th, and chopped out accurately, "one hoe chop" one stalk to the hill. The following are the results:

PLAT NO. V.—COTTON.

Object—To determine best width of rows.
Variable—Width of row.
Constant—One stalk every "hoe chop."

No. of Experim'nt.	Width of Rows in feet.	First Picking, Sept. 4th.	Second Picking, Sept. 12th.	Third Picking, Oct. 4th.	Fourth Picking, Nov. 12th.	Total Yield.	Rows to an Acre.	Total Yield Per Acre.
1	2½	8 lbs.	7 lbs.	4½ lbs.	1 lbs.	20½ lbs.	168	1148 lbs.
2	3	10	6½	3	1	20½	140	956
3	3½	7	8½	8½	2½	26½	120	1060
4	4	5	5	13	6	29	105	1015
5	4½	4	7½	13½	6½	31½	93⅓	980
6	5	5	7½	14½	6	33	84	924
7	5½	6	10½	12	6½	35	76 4-11	891
8	6	6	10½	11	7	34½	60	805

It is plain from above that while the wide rows have given the largest yield to the experiment, the narrow rows have given the greatest yield per acre and suggest the proper widths of rows for cotton in such lands as this soil, to be from 2½ to 4 feet.

PLAT NO. VI.—COTTON.

Object—To test distance required by cotton in the drill to obtain best results. It was treated exactly like Plat V., both in the method of breaking, manuring and planting. Here the rows were all four feet apart and three rows taken for each experiment. It was carefully chopped out, leaving one stalk every 8, 12, 16, 20, 24, 30, 36, 42 and 48 inches respectively for each experiment. By a misunderstanding several varieties of cotton were used on the plat which may invalidate the extreme accuracy of the results. The following are the results:

RESULTS OF PLAT VI.—COTTON.

Object—To determine distances in drill for cotton.
Variable—The distance in drill.
Constant—Width of row.

No. of Experim'nt.	Dist'nce apart in drill. One stalk every	First Picking, Sept. 4th.	Second Picking, Sept. 12th.	Third Picking, Oct. 4th.	Fourth Picking, Nov. 12th.	Total Yield.	Total Yield Per Acre.
1	8 in.	19 lbs.	$20\frac{3}{4}$ lbs.	$11\frac{1}{2}$ lbs.	$3\frac{1}{2}$ lbs.	$54\frac{1}{2}$ lbs.	1907 lbs.
2	12	15	22	9	5	$51\frac{1}{2}$	17·5
3	16	17	$21\frac{1}{2}$	$8\frac{1}{2}$	5	52	1820
4	20	15	$19\frac{1}{4}$	$8\frac{1}{2}$	$5\frac{1}{2}$	$48\frac{1}{4}$	1689
5	24	14	$18\frac{1}{2}$	8	$4\frac{1}{2}$	45	1575
6	30	13	17	$7\frac{1}{2}$	3	$40\frac{1}{2}$	1417
7	36	13	$15\frac{1}{4}$	8	$3\frac{1}{2}$	$39\frac{3}{4}$	1391
8	42	9	$14\frac{1}{2}$	$9\frac{1}{2}$	5	38	1330
9	48	9	$12\frac{1}{4}$	$7\frac{1}{2}$	4	$32\frac{3}{4}$	1146

There is an uncertainty in the above experiment that vitiates absolute certainty—i. e., the use of different varieties of seed. But it is plainly shown that distances from 8 to 20 inches are productive of the largest results.

PLAT VII.—COTTON—VARIETIES.

There are many varieties of cotton offered yearly on our market, with flaming certificates of great excellence and eulogistic testimonials of high merit. The Station here and at Baton Rouge last year determined to test as many of these varieties as they could obtain. Accordingly at a great cost of labor, time and money, every variety of merit that could be heard of was obtained. They were placed under exactly the same conditions and treated as far as possible exactly alike. Excellent stands were obtained and with great care they were chopped out, leaving one stalk in hill at equal intervals. They were picked and weighed, and each variety separately ginned on an improved 20-saw Gullett gin with feeder and condenser, and lint, seed and motes each carefully weighed. Arrangements had been made with an expert in Vicksburg to measure the length of the staple and classify each commercially, but samples were not reserved.

The following are results:

RESULTS PLAT VIII.—COTTON—VARIETIES.

No. of Exp't.	Name of Variety.	Yield per Acre.	Per cent. of Seed.	Per cent. of Lint.	Per cent. of Motes and Dirt.	Yield of Lint, per Acre.	Remarks.
1	Sea Island—Pure	....	....	....	......	......	Pure Seed from New Orleans.
2	"	....	76.74	22.4	.86	......	Grown one year at Baton Rouge.
3	Allen's Long Staple	1548 lbs.	69.80	29.8	.4	461	" " "
4	" "	1491	67.00	32.1	.9	462	Seed obtained from Georgia.
5	Tennessee Silk	1575	69.10	30.3	.6	477	Seed obtained from New Orleans.
6	" "	1588	67.4	30.1	2.5	478	Grown one year at Baton Rouge.
7	Shine's Early	1575	68.8	31.7	.5	499	Department of Agriculture, Washington, D. C.
8	Boyd's Prolific	1463	69.7	30.8	.5	451	Grown one year at Baton Rouge.
9	" "	1601	68.4	31.1	.5	498	Seed obtained in New Orleans.
10	Cherry's Long Staple	1496	68.3	30.4	1.3	455	Department of Agriculture, Washington.
11	S. Maxey's	1627	68.7	30.7	1.6	498	" " "
12	Jower's Improved	1653	67.0	32.6	.4	509	Seed obtained from Georgia.
13	Jones' Improved	1785	67.9	30.5	1.6	544	" "
14	Martin's Prolific	1627	68.3	30.4	1.3	495	Department of Agriculture, Washington.
15	Herlong	1601	68.9	29.9	1.2	479	Seed obtained in New Orleans.
16	Bancroft's Herlong	1548	67.8	31.	1.2	480	Seed grown at Baton Rouge.
17	Oats	1838	68.6	30.6	.8	562	From public gin in Baton Rouge.
18	Little Brannon	1575	67.4	31.8	.8	501	From Station, Baton Rouge.
19	Peterkin	1628	63.8	35.8	.4	583	" "
20	"	1627	63.7	36.	.3	586	From Augusta, Ga.
21	Hawkin's	1759	68.4	30.	1.6	528	Department of Agriculture, Washington.
22	McGehee Southern Hope	1576	70.1	28.6	1.3	451	From Mr. McGehee, Mississippi.
23	Petit Gulf	1732	68.1	30.9	1.	535	From New Orleans.
24	Peeler	1592	68.4	30.6	1.	487	" "
25	Crawford's	1680	67.8	31.4	.8	527	From Georgia.
26	Peerless	1715	68.2	30.7	1.1	526	" "
27	Carolina Pride	1654	69.7	29.4	.9	486	From South Carolina.
28	Dickson's	1814	67.3	31.1	1.6	564	From Mr. Dickson, Georgia.
29	King's Improved	1732	67.1	32.1	.8	556	Department of Agriculture, Washington.
30	Cherry's Cluster	1444	68.9	29.1	2.0	420	" " "
31	Welbourn's Pet	1733	67.5	30.	2.5	520	" " "

A close inspection of above table will show that the yield of seed cotton per acre varies from 1444 lbs. to 1838 lbs., while the yield of lint per acre runs from (excluding Sea Island) 420 lbs. to 586 lbs. The seed which shows the highest yield of seed cotton per acre and the next to the largest yield in lint has a singular history. In 1886, at Baton Rouge, there were two acres devoted to experiments in oats. These oats were harvested the last of May, the land was plowed and planted in June in cotton and not chopped out until July 5th. The subsequent seasons were excellent and the two acres gave a yield of over a bale per acre. Having exhausted our own seed in planting in spring, we sent to a public gin in Baton Rouge and borrowed two bushels of seed from a large pile then on hand. These seed were planted with a planter and an excellent stand obtained. In the fall a stalk with all of its bolls of each variety (22) specially left for the purpose was dug up and exhibited at the Central Fair Association in Baton Rouge. Along with the varieties were exhibited a stalk of this cotton, then filled with open bolls. This cotton attracted great attention and the subsequent yield per acre, together with frequent applications from farmers who saw it at the Fair for seed, determined us to propagate it. To distinguish it from other varieties used, the farm superintendent labeled it "Oats" cotton and it has since borne that name. The seed were raised somewhere around Baton Rouge, but from what variety of seed is unknown. It more nearly resembles the "Brannon," a variety largely planted around Baton Rouge and very highly esteemed but is distinctly different from it. Its origin is shrouded in mystery and yet in this trial and another at Baton Rouge this year with a larger number of competitors, it has proven itself the superior of many of the so-called pedigreed cottons upon which time and money have been prodigally expended in propagating and developing. Unfortunately only the seed used in these experiments were last year planted and hence the supply is quite limited, while the demand is very large.

An inspection of above tables will show that many of the above-named varieties are without any apparent merit, on this soil, and caution is necessary on the part of our farmers before they procure new seed in large quantities or abandon an old and tried variety for a new and untried one. Here as elsewhere it is best to go slowly and await the trials and approval by the Experiment Stations of all new crops before any considerable investment in seed, etc.

CORN EXPERIMENTS

were of three kinds. 1st, Manurial requirements. 2d, Distances in row, and 3d, Varieties.

PLAT NO. II.

was devoted to questions of manurial requirements by corn, and the following are the list of experiments with yield, etc.:

PLAT NO. II.—CORN—MANURES.

No. of Experim'nts	Kind and Quantity of Manure Per Acre.	Yield of Corn in Shuck, per acre.
1	No Manure	476 lbs.
2	280 pounds Cotton Meal	1008
3	280 " Acid Phosphate	532
4	280 " Kainite	504
5	280 " Cotton Meal 280 " Kainite	952
6	280 " Cotton Meal 280 " Acid Phosphate	840
7	280 " Acid Phosphate 280 " Kainite	476
8	280 " Cot. Seed Meal, 280 " Acid Phosphate 280 " Kainite, } In Drill	1134
9	Same as No. 8, broadcast	1344
10	No Manure	588
11	420 pounds Cotton Meal 140 " Acid Phosphate	1148
12	420 " Cotton Meal, 140 " Acid Phosphate 140 " Kainite, } In Drill	1050
13	Same as No. 12, Broadcast	1064
14	280 pounds Cotton Meal 140 " Acid Phosphate	812
15	280 " Cotton Meal, 140 " Acid Phosph'te 140 " Kainite, } Broadcast.	700
16	Same as No. 15, in Drill	630
17	140 pounds Cotton Seed Meal 280 " Acid Phosphate	336
18	140 " Cot. Seed Meal 280 " Acid Phosphate 140 " Kainite, } In Drill.	280
19	Same as No. 18, Broadcast	602
20	No Manure	588
21	560 pounds Cotton Seed	952
22	560 " Cotton Seed 280 " Acid Phosphate	1078
23	560 " Cotton Seed 280 " Acid Phosphate 280 " Kainite	1022
24	840 " Cotton Seed	1218
25	840 " Cotton Seed 280 " Acid Phoshate	1148
26	840 " Cotton Seed, 280 " Acid Phosph'te 280 " Kainite, } In Drill	742
27	Same as No. 26, Broadcast	700
28	No Manure	574

Manures prepared and put out April 11th. Opened with shovel plow and covered with scooter and shovel. Corn planted April 13th. Opened with scooter and covered with hoes. Variety used, "Calhoun Red Cob."

The results of this plat are not satisfactory and no definite inferences can be drawn beyond the fact that both Cotton Meal and Cotton Seed are excellent sources of Nitrogen for corn.

PLAT VII.—CORN.

Experiment—Different width of rows. A plat, ½ acre in depth, was broken, and over it scattered broadcast 150 lbs. of the mixture described under Plat V. The rows were then laid off, from 4 to 7 feet, taking three rows to each experiment. It was planted by measure, 2 feet in drill, and thinned out to one stalk in hill. Variety used—McLendon's "Shoe Peg."

RESULTS PLAT VII.—CORN.

Object—To test width of rows.
Variable—Width of row.
Constant—Distance—2 feet in drill.

No. of Exp't.		Width of Rows in	Yield per Acre.
1	....	4 feet.	2695 lbs.
2	....	4½	2875
3	....	5	3486
4	....	5½	2876
5	....	6	2338
6	....	6½	1874
7	....	7	1380

Here the 5-foot rows have given the best results, but it must be remembered that this was a fair piece of land and seasons were upon the whole very good. Upon thinner land and a drouthy season the wider rows might have done better.

PLAT XIV.

Upon this Plat a test was made to see how large a yield of corn could be made on this, our best plat, at this late date, April 16th.

Five rows were taken to each experiment. The corn was planted in 5-foot rows, 18 inches apart. It was up, had been thinned and worked when following applications of manures were made, May 17th, as a top dressing, per acre:

No. 1. { 150 lbs Nitrate Soda.
225 lbs Acid Phosphate.
75 lbs Sulphate Potash.
300 lbs Gypsum.

No. 2.	300 lbs Dried Blood. 225 lbs Acid Phosphate. 75 lbs Sulphate Potash. 300 lbs Gypsum.
No. 3.	75 lbs Nitrate Soda. 150 lbs Dried Blood. 225 lbs Acid Phosphate. 75 lbs Sulphate Potash. 300 lbs Gypsum.
No. 5.	120 lbs Cotton Seed Meal. 120 lbs Acid Phosphate. 60 lbs Kainite.

Each of above experiments contained five rows. On Nos. 1 and 2, two rows of each had the fodder pulled at regular time, leaving the other three rows unpulled. The following are the results per acre:

Yield per acre of No. 1—Fodder pulled	3037 lbs.
" " No. 1—Fodder not pulled	3557 lbs.
" " No. 2—Fodder pulled	3356 lbs.
" " No. 2—Fodder not pulled	4024 lbs.
" " No. 3—Fodder not pulled	3405 lbs
" " No. 4—Fodder not pulled	2416 lbs.

Here in No. 2, fodder not pulled has produced 53 bushels shelled corn.

When the fodder was removed, as is usually done all through North Louisiana, there was an actual loss of 520 lbs. in No. 1, and 668 lbs. in No. 2, of corn, caused by fodder pulling, amounts equalling about 7 and 9 bushels per acre, or say 15 and 20 per cent of corn, made. With forage crops given elsewhere, so easily grown and cured into hay, surely it is wrong to pull fodder from our corn.

PLAT NO. IX.—CORN VARIETIES.

Plat half an acre deep. Rows five feet apart. Six pounds of the mixture described under Plat V. was carefully mixed in each row. Three rows taken for each experiment. Manure distributed and corn planted April 16th. Corn gathered Sept. 28th. It was weighed in shucks; then shucked and shelled, and shuck, cob and grain weighed separately. On the next page are given results:

RESULTS OF PLAT IX.—VARIETIES OF CORN.

No. of Experim'nt.	Name of Variety.	Where Obtained.	Yield Per Acre in shucks.	Per cent Grain.	Per cent Cob.	Per cent Shuck.	Yield Per Acre in Shelled Corn.	Kind of Corn.
1	Alabama	From Alabama	2478 lbs.	76.71	16.43	6.86	35.71	White Dent.
2	McQuade	From John McQuade, Baton Rouge	2856	75.32	18.18	6.50	38.11	White Dent.
3	Patterson	From R F. Patterson, Baton Rouge	2212	79.12	13.58	7.30	31.25	White Dent.
4	Calhoun	From A. Calhoun, Calhoun	2450	82.05	11.53	6.42	35.89	Shoe Peg and Red Cob.
5	McLendon	From R. W. McClendon, Ouachita	1806	81.54	12.31	6.15	26.20	Regular Shoe Peg Seed.
6	Mosby	From Dep t of Agriculture, Washington	2128	77.96	10.17	11.86	29.62	White Dent.
7	Blount	From N. S. Doherty, Baton Rouge	2289	75.82	13.02	10.90	30.99	White Gourd Seed.
8	White Mexican	From D. R. Calder, St. Mary's	2338	76.56	17.20	6.24	31.96	White Dent.
9	White Normandy	From Department of Agriculture	2142	70.00	18.57	11.43	26.77	White Dent.
10	Chamb'rlin's Prolific	From Mr. Chamberlin, Baton Rouge	2954	76.92	15.40	7.68	40.57	White—Several ears on stalk.
11	Southern Prolific	From New Orleans	2537	76.20	14.30	9.50	34.52	White—Several ears on stalk.
12	Mexican White Flint	From D. R. Calder, St. Mary	2450	76.06	16.90	7.04	33.27	White Flint.
13	Mexican and Creole.	From D. R. Calder, St. Mary	2450	69.44	18.06	12.50	30.37	Yellow Flint.
14	Western Yellow	From Lucien Soniat, Jefferson	1040	75.00	15.00	10.00	25.95	Yellow Dent.

PLAT X.—FORAGE CROPS.

Mention has been made of injury sustained by the corn crop in pulling off its leaves for fodder. The experiments, described elsewhere, have been repeatedly carefully made, and always with concurrent results, viz., a loss from 8 per cent to 20 per cent of the corn made. In Louisiana, where crab and Bermuda grasses grow so abundantly, and which, when cut at the proper time and cured, will make excellent hay, there is no excuse for pulling fodder. Were we without these valuable grasses we have now other forage crops, which are easily grown and cured into hay; besides furnishing, in many instances, enormous quantities of seed, which are valuable substitutes for corn. The following, upon properly prepared and manured ground, were grown:

TEOSINTE—"REANA LUXURIANS."

"Of South American origin, largely excelling all other known plants in size of growth and great amount of foliage produced. It throws up fifteen to thirty stalks from a grain, and on rich land reaches 15 feet in height, a solid mass of foliage. Cut for green feed in any stage it is found good and wholesome, and the second and third growths come promptly in equal vigor and abundance. Nothing equal to it for an enormous mass of forage. Requires fertile soil; does not mature seed in this climate. Plant in April, 5x6 feet, and cultivate as corn."

The above is a description taken from a seed catalogue. This plant matured its seed this year at Sugar Experiment Station, near New Orleans, and they will be distributed over the State to farmers and planters. It is a perennial in its native habitat, but after growing it three years at Baton Rouge no indication has yet been given of its stubbling or rattooning. This year it will be watched closely at Kenner. The following note was made by Mr. Calhoun, Farm Superintendent, relative to this plant: "From one seed it will sucker sufficiently to cover an area 2x3 feet. Is a fine green food for all kinds of stock. Horses eat it ravenously. It cures into hay very slowly, and does not stand hot dry weather."

PEARL MILLET—"PENICILLARIA SPECATA."

"This is an old familiar favorite, known throughout the South as Cat-tail Millet, Horse and Egyptian Millet. It stools

largely from the ground and makes a great mass of foliage, can be cut several times in a season, furnishing fresh growth as long as season suits. Useful only for green feeding; does not cure into good fodder, nor is the grain suitable for feeding. Sow in April, in drills 4 feet apart, or drop a few seed in hills 2x4 feet. Cultivate as corn."

What is said above of this plant is found to be true by Mr. Calhoun, who makes the following remarks: "An excellent green feed. Can be cut every two weeks. Will not cure into hay." It is useful only as a soiling crop.

KAFFIR CORN.

"This grain was first disseminated in 1887, and has attracted a large degree of attention and favor. For some reasons it promises to be one of the best plants for grain and forage, as it is certainly one of the most vigorous, handsome and productive. It is a variety of Sorghum, non-Saccharine, distinctly differing in habit of growth and other characteristics from others of that class. The plant is low, stocky, perfectly erect, the foliage is wide, alternating closely on either side the stalks. It does not stool from the root, but branches from the top joints, producing from two to four heads of grain from each stalk. The heads are long, perfectly erect, well filled with white grain, which at maturity is slightly flecked with reddish brown spots. Weight, 60 lbs. per bushel. The average height of growth on good, strong land, is 5½ to 6 feet, on thin land 4½ to 5 feet. The stalk is stout, never blown about by winds, never tangles, and is always manageable, easy handled. A boy can gather the grain or fodder. The seed heads grow from 10 to 12 inches in length, and produce on good land reaches 50 to 60 bushels per acre.

"It has the quality common to many Sorghums of resisting drought. If the growth is checked by want of moisture, the plant waits for rain, and then at once resumes its processes, and in the most disastrous seasons has not failed so far to make a crop. On very thin and worn lands, it yields paying crops of grain and forage, even in dry seasons in which corn has utterly failed on the same lands.

"The whole stalk, as well as the blades, cures into excellent fodder, and in all stages of its growth is available for green feed, cattle, mules and horses being equally fond of it. If cut down to the ground two or more shoots spring from the root, and the growth is thus maintained until checked by frost. For ensilage it is one of the most desirable.

"The Kaffir Corn may be planted in March, or early in April. It bears earlier planting than other Millets or Sorghums. It should be put in rows not over three feet apart, even on best land; should be massed in the drill on good land, for either grain or forage purposes, and also on thin land, if forage mainly

is desired. Cultivate as common corn. It matures as early as Early Amber Cane. Use 3 to 5 lbs. seed per acre.

"The seed heads form at top of stalk, and the joints next below send up shoots which the second, third, and often fourth seed-heads. If the crop is wanted mainly for fodder, it is recommended to cut down the whole stalk when the first seed-heads come into bloom, at which state it cures admirably. The second growth still matures a full crop of forage before the middle of October.

"Flour from the Kaffir Grain has been found more nearly analogous to wheat than any other grain of its class, for batter cakes, muffins, etc., it is excellent, scarcely distinguishable from wheat; and for buckwheat cakes is an improvement on the original."

The above from Alexander's Catalogue is so descriptive of the plant that it is inserted for the instruction of our readers. At Calhoun this plant last year obtained a growth of 4 to 5½ feet, and each seed-head weighed about 3 to 4 ounces. The seed are also valuable for poultry feed. This plant was cured into hay the last of September and gave 12.28 tons of dry hay per acre. A few young seed-heads cured with it.

MILO MAIZE.

"Of South American origin, has been well advertised and distributed. Valuable as a forage plant and for grain, having great capacity to stand drought. It can be cut and fed at any stage, or cured when heading out, for fodder. It bears grain in erect full heads, and is almost equal to Corn for feeding; also makes excellent Meal. The yield of grain will average 30 bushels per acre on land that will make fifteen of Corn. It requires all summer to mature seed. Plant in April, three to five seed in a hill, 18 inches apart, 4 to 5 foot rows, and thin to two plants and cultivate as Corn. It shoots out greatly and makes a great amount of foliage. Three to five lbs. per acre. Can be cut for green feed several times a season."

At Calhoun the stalks were of medium size and late, heads heavy and regular, cures rapidly, three or four hours hot sunshine sufficing. Suckers vigorously after the first crop is removed. This plant gave at the rate of 13.04 tons cured fodder per acre, or 39.30 bushels of Seed. Seed-heads resembled the African Millet, but smaller and fewer seeded. Seed are white, with slight pink on ends with dark glumes.

WHITE DHOURA, OR LARGE AFRICAN MILLET.

"A variety of Sorghum, non Saccharine, growing a single stalk 8 or 10 feet high, and yielding heads of grain 12 to 14 inches long, weighing 6 ounces to a half-pound when fully ripe. The foliage corresponds to the foliage of amber cane. If the whole stalk is cut down and cured when the seed are in dough state, it makes excellent forage, easy to cure, keeps well in out-door shocks, and well eaten by stock through the winter. If cut in the green state, they make excellent green food, and the shoots that spring at once from the root make a second crop of forage.

"The grain is clean, white, flinty, weighs full 60 lbs. per bushel, makes a good palatable Meal for human food. All farm animals eat of it freely and do as well as on corn. It may be used continuously without fear of ill results.

"In appearance this grain is hardly distinguishable from the Milo Maize, or Rural Branching Dhoura, and has been often confounded by seedsmen. But it has been generally more popular than the Milo Maize, because it does not stool nor make the mass of forage that Milo does, yet it is so much quicker growth, maturing in 90 to 100 days. One head of the seed is fully equal to a good ear of Indian Corn, and the yield per acre will be three times as much as of Corn. It bears dry weather, and makes its crop where corn would wholly fail.

"Plant in early April; in 3-feet rows, leaving one or two plants every 12 inches in the row, and cultivate as Corn."

At Calhoun this plant gave a large tall stalk with heavy foliage, cures rapidly, four hours sunshine sufficing. A good seed-head on nearly every stalk. Will stand crowding to 6 inches in drill.

It gave when harvested on Sept. 29th 13.82 tons of excellent hay and 47.25 bushels of seed, after considerable depredations, One dozen average stalks gave five pound seed heads. The latter are long, large and heavy—seed are white with pinkish tint and black glumes.

RURAL BRANCHING SORGHUMS OR YELLOW MILO MAIZE.

"This growth is tall, eight to twelve feet, stooling from the ground like the white "Branching Dhoura," or Millo Maize, but not so much. It sends out also shoots from the joints. The seed head grows to great size on good land, often weighing three-fourths of a pound; sometimes a full pound after being fully ripe. The grain is double the size of White Milo, and of deep golden yellow color. Weight, sixty pounds per bushel.

"In shape the seed head is thick, well-shouldered, solid, and by size and weight each is the full equal of a fine ear of Corn. The heads turn down, and when ripe it hangs on a short goose-neck stem. The plant possesses all the vigor and vitality of other Sorghums. It is non-saccharine, useful only for the large amount of forage, green feed or cured fodder that it furnishes, and for its grain which is so fine in appearance, abundant, and well eaten by mules, horses, cows and hogs.

"It is much earlier in maturing than the White Milo Maize, ripening seed by the middle of July, and for this reason is more reliable than the later white variety. It may be cut down for green feed at any stage of its growth, and comes again promptly, often yielding three or four good 'cuttings' in a season. It is well eaten by all farm stock. The fodder, cured as Corn blades are cured, is of equally good quality, and the quantity of it is enormous. On account of its branching habit and tall massive growth, this grain should be planted in four to five-foot rows, and six inches in the drill, according to the quality of the land. The cultivation is like Corn. It is early enough to be adapted to cultivation in the Northern States, as well as the South, and by its massive growth, is highly suitable for ensilage."

At Calhoun this plant was large and tall with heavy foliage, large heads, inclined to mildew in protracted damp weather. Requires six hours hot sunshine to cure. Stock fond of it. It gave 13.65 tons of cured fodder per acre and 31½ bushels seed. Seed yellow with black glumes. When cut, Sept. 29, it had many immature seed heads shooting from sides of stalks.

Two rows, one-half acre long, of the last three, Millo Maize. Large African Millet and Rural Branching Sorghum were left to produce seed. From these two rows were taken a large number of seed heads by farmers visiting the Station. This privilege was given to all visitors and was freely exercised. The large African Millet suffered the most, on account of the attractiveness of its large plump heads. When the crops from these rows were harvested the seed heads actually obtained were weighed and threshed and a number of bushels per acre ascertained. The stalks on these rows were all accurately counted and then 12 average stalks selected and their seed heads removed, weighed, threshed and net grain weighed and a calculation made for an acre.

Below are actual and calculated results of each per acre:

	Seed actually obtained.	Seed calculated.
Rural Branching Sorghum	31.50 bushels.	46.20 bushels.
Milo Maize	39.30 "	55.30 "
Large African Millet	47.25 "	107.12 "

Besides the above-mentioned Forage crops, Plat XI was devoted to Sorghums for the double purpose of testing their capacity for sugar making and for forage purposes.

They were all subjected to careful chemical analyses in September and results published in Bulletin No. 19.

The rest of the plants were cured into fodder. The following varieties used:

EARLY AMBER SORGHUM.

Stalk small, and heads light. Matures several weeks ahead of any other variety. Too small for much tonnage.

EARLY ORANGE.

Medium stalk, heavy heads; cures well into hay. Matures two to three weeks later than Early Amber. An excellent variety for forage.

NEW ORANGE.

Similar in every respect to Early Orange.

WHITE INDIA.

Very large stalk, heavy white seed heads. Matures much later than Amber. Cures well. Tonnage heavy. Excellent for forage.

LINK'S HYBRID.

Heavy heads. Very large stalks. Cures well. Matures with White India. Tonnage heavy. Excellent for forage.

GOLDEN ROD.

Large stringy heads. Stalk quite large and tall and red in color. Cures well. Tonnage large.

With above forage crops so easily and cheaply grown and so easily cured into fodder, there is no reason why we should pull fodder, or even be without an abundance of forage. They suggest too the possibilities of stock-raising in the near future, when we shall grow tired of raising all cotton.

PLAT XIV

was devoted to sundry crops, as follows:

Brazillian Flour Corn.—A small variety of maize; very delicate in growth; small stalk. It gave with us two to five succors to each stalk, with a more or less developed ear on each. The corn is very soft, easily destroyed by weevils and makes a white meal resembling somewhat wheat flour. A thorough trial with chemical analysis will be given another year. It may become acclimated, if so it may then be valuable as bread corn. At present it seems unworthy of cultivation.

Buckwheat.—Germinates, grows and matures in a very short time, permitting three crops annually on same soil. Havy rains and very damp weather seem disastrous to this crop while fruiting, causing mildew to fruit and blight to stalk. Sown broadcast and turned under is a good renovator of worn soils. It is also excellent for bees.

Chapman's Honey Plant.—Very delicate while young—requiring good seasons—does not stand drouth well. Our plants are now one year old and the next year or two will decide their merits. It is said to be excellent for honey bees.

Spanish Peanut.—A desirable variety, early, a fine bearer, growth perfectly erect, not spreading on the ground like the common kinds of peanut, and therefore easily cultivated, the plow doing all the work. Also, in harvesting, all the Peas hang to the root and can be rapidly gathered. Planted in April they ripen in August, and planted as late as July 1st to 10th, will mature full crops before frost. Therefore they are useful to follow after oats. The stems grow erect, are easily harvested for forage, making the richest quality of hay. The Pea is smaller than the Virginia Peanut, but very sweet, fills out well, makes no pops. Can be planted close in the row and in the drill, yield.

ng largely per acre. Splendid to fatten hogs and children. The vine retains its greenness much longer than other varieties, suggesting its superiority for forage. Yield very large.

Virginia Peanut.—Vines large and growing flat on the ground, fruiting from tap root to extremity of vine. Fruit faulty; two to four nuts to pod. Pods large and colored light pink. Yield medium.

Georgia Red Peanut.—Vines medium size, growing up from the ground and fruiting principally near the tap root. Pods faulty; three to four nuts each. Color red.

PLAT XIII.

was devoted to Cow Peas. Unfortunately, but little is known of the botany of this genus of plants, which has been erroneously styled a pea. It is really a bean, "Dolichos," but the species under this genus have never been fully determined. Of varieties we have a great number, presenting differences in habits of growth and maturing, and giving seed of every size and quality, and of every shade of color from the purest white to the deepest black. This crop is highly prized for fertilizing purposes among the sugar planters of South Louisiana, but elsewhere throughout the South it does not receive one-half the attention which its valuable properties should merit. In time it is hoped that both its botany and its economical position in Southern agriculture will be both fully understood.

The following varieties were this year grown:

"*Pea of the Backwoods, or 'The Old Man's Friend.'*—This pea was brought to notice two years ago by the letters of Mr. Edward Fonville, of Onslow county, N. C., in the *Southern Cultivator*. It was recommended as the earliest bunch pea, and excellent for table use. It has so proved, two weeks ahead of any other, a larger bearer, and as a shell pea for table use, tender, marrowy and palatable. Are ripe for table use just six weeks after planting. It is a bunch pea strictly, therefore affording not much vine. The seed are small, cream colored, slightly 'pied.' Very prolific."

At Calhoun it matured in forty days. Two crops a year were grown on same ground last year at Baton Rouge.

"*The Unknown Pea.*—Is a greenish white color, full size, makes much vine, vigorous growth, large bearer. Pods long

and very full, and in favorable seasons continues to make or bear fruit during several weeks. It is a very fine pea, worthy to come into general use. The Boss Pea advertised last year proved to be identical with the Unknown."

At Calhoun it was very late bearing and gave only a moderate yield of peas, but exceedingly heavy foliage.

"*The Conch Pea.*—A small white pea, of delicate table quality; a great producer, remarkable for the amount of vines it makes, often 30 feet in length, on good soil. The vine runs close to the earth, shades the land well, and produces a great amount of hulm for fertilization, besides a full crop of peas. Plant in May. One quart will cover an acre densely with vine, if planted two or three in a hill, 6 to 10 feet apart. Closer planting will not make seed, though plenty of vine. Among fruit trees and grape vines it keeps down the growth of weeds and enriches the land."

At Calhoun the vines grew to great length, completely covering the ground, but gave no fruit. At Sugar Experiment Station, when planted in hills 6 to 10 feet apart, it bore a moderate crop of berries.

Dwarf Whippoorwill Pea.—A bunch pea, with but little vines. Begins fruiting in fifty or sixty days. Berry speckled, pods long and full, yield good.

Clay Pea.—Vines and foliage medium. Begins fruiting in seventy-five days. Yield good. Berry cream colored with white eye, medium in size. Pod of medium length and not crowded.

Lady Pea.—A small white pea, with considerable vine of medium foliage. Begins fruiting in ninety days from time of planting.

White Prolific Pea.—Vines large; foliage heavy; yield of peas good. Bears in eighty to ninety days. Berry large and closely resembling the next variety.

Large White Pea.—Vines and foliage heavy; very late fruiting. A large white pea and very prolific.

Indian Pea.—A large "liver and white pied" pea, with long and crowded pods. Very prolific. Vines and foliage heavy. Begins fruiting in sixty to ninety days. Berry soft and does not keep well.

King's Pea.—A large black and white pied pea. Large and crowded pod. Vines and foliage heavy. Very prolific. Begins fruiting in sixty to seventy days. Berry too soft to keep well.

Red Ripper Pea.—A large red pea, with long and crowded pods. Vines and foliage medium. Bears fruit in seventy-five days.

Soja Bean.—Very dwarfy. Fruits badly, and seed of no value with us. Will stand neither wet nor dry weather in this climate. This is the third season's trial of this crop in Louisiana and each year a failure. It is deemed unworthy of further trial anywhere in this State.

SUGAR CANE.

LABORATORY AND SUGAR HOUSE RESULTS.

DIFFUSION PROCESS.

BULLETIN No. 23

OF THE

LOUISIANA SUGAR EXPERIMENT STATION,

KENNER, LA.

WM. C. STUBBS, Ph. D.,

DIRECTOR.

ISSUED BY

THOMPSON J. BIRD,

COMMISSIONER OF AGRICULTURE, BATON ROUGE, LA.

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1889.

SUGAR EXPERIMENT STATION,
KENNER, LA.

Major T. J. Bird, Commissioner of Agriculture, Baton Rouge, La.:

Dear Sir—I herewith enclose the results of Laboratory and Sugar House experiments in Sugar Cane, obtained during the past season and ask that they be published as Bulletin No. 23.

Respectfully submitted,

WM. C. STUBBS,

Director.

DIFFUSION OF SUGAR CANE.

Through the appropriations made by the State Bureau of Agriculture and the Department of Agriculture at Washington, D. C., the Sugar Experiment Station was enabled to conduct a series of field, laboratory and sugar house experiments with sorghum—results of which have been fully described in Bulletin No. 19 of Louisiana State Experiment Station and Bulletin No. 20 of the United States Department of Agriculture, Division of Chemistry.

The experiments in sorghum which were discontinued in October, were succeeded by those with sugar cane, and the machinery erected in the sugar house, especially for sorghum, was, with slight alterations and modifications, adapted to the work on sugar cane.

The following description, published in the *Louisiana Planter*, of September 8th, will serve to give a general idea of the diffusion outfit and other accessories for the successful manufacture of sugar from sorghum:

"The sorghum cut down in the field is brought to the sugar house with its leaves and tops and placed on a cane carrier, butts forward. The carrier conveys it to a rapidly revolving cylindrical frame with two heavy knives, where it is cut into pieces of $\frac{3}{4}$ to 1 inch in length. Between the carrier and the knives is an open space of about 12 inches, through which, into a shute, fall the tops by their own weight whenever they are unsupported at both ends. The cut pieces of cane are dropped from the knives through a perpendicular distance of ten feet. At the same time they are acted upon by a powerful blower, similar in action to a rice or wheat *fan*. This blast, aided by a shaker, removes the adhering fodder and drives it to a carrier, which takes it from the mill. In a large mill with bagasse burner it is carried to the furnace and serves as a fuel.

"The clean pieces of cane are now taken by a conveyor and carried to another cylinder with four knives, where they are now comminuted into very small chips. These in turn are taken by another conveyor and carried over the diffusion cells, where through openings and a spout, each cell can be filled. The diffusion battery consists of fourteen cells, each with a capacity of 13.52 cubic feet and arranged in double lines. A large cistern, forty-five feet high, supplies the battery with water, while a barrel of water on the top of the cistern makes the hydraulic joints at the top and bottom of each cell.

"An air pump and condenser supplies the air to drive the juice from the chips, and the latter, after exhaustion, are dumped into a car under the battery, which removes them to the field. A large heater on the floor and a small heater to each cell supply the heat to the water, while an inverted thermometer shows the temperature. Each cell has a small pet cock, by which juice from each cell may be taken for analysis.

"The battery is so arranged that the juice may be sent to the settling tanks to be treated with tannic acid; to the sulphur machine to be sulphured; to the clarifier to be defecated in any manner desired, or directly to the double effect.

"It is also arranged so that the scums and settlings can be easily returned to the cells or sent through the filter press. After clarification the juice is sent to an upright double effect and there concentrated. The vacuum strike pan and the centrifugal completes the operation of the manufacture of sugar. Scales have been provided for accurate weighing at the different stages of manufacture. A large wagon scale in the yard weighs the cane. Another large pair, sunk in the floor of the sugar house, weighs the juice, syrup, sugar and molasses, while a portable platform scale by the vacuum pan serves to weigh the syrup before entering the pan and the masse cuite afterwards.

"The laboratory has also been improved to keep pace with the sugar house. A new, large and accurate Schmidt & Haensch polariscope has just been imported. This has a double compensation by which each reading can be made four times, thus avoiding the error that may arise from single readings. A

Kjeldahl's battery, for the rapid determination of albuminoids, has also been erected. With this battery will be made accurate determinations of the albuminoids in the raw juices, in the scums, in the juices clarified by different processes, in the syrups and in the molasses. In this way much information relative to the efficacy of the different clarifying agents will be gained.

"Of the latter there is on hand a supply of sulphur, lime, carbonate of lime, tannic acid, superphosphates of lime and alumina and bisulphite of lime. For filtering media the station has German and Alabama lignite, charcoal, sawdust and rice hulls.

"Mr. Maurice Bird, a graduate of the University of Virginia and a chemist of considerable reputation and experience, has succeeded Mr. W. L. Hutchinson and has charge of the laboratory. He is assisted by Mr. T. H. Jones, a graduate of the A. and M. College of Alabama, and Mr. W. P. Martin of Lafourche, a graduate of the University of Louisiana at Baton Rouge.

"Mr. J. P. Baldwin, of St. Mary, has charge of the sugar house and will be aided by Mr. D. N. Barrow and Mr. J. G. Lee assistants from Baton Rouge and Calhoun. Mr. Fyler, of North Carolina, will also work in the sugar house."

October 13th—The first experiment with sugar cane was made with cane cut down in the field with leaves and tops on. This experiment was made to see if the machinery which had successfully topped and stripped sorghum would not do the same with cane. It successfully topped and stripped the cane but it also sent too many green joints into the diffusors, which greatly lowered the purity of the juices. No arrangements had been made to carry off the tops and trash and it was soon discovered that these accumulated in such quantities as to require hand labor to remove them. This to us was a great inconvenience, but it suggested at once a source of profit to the sugar manufacturer. By cutting the cane and permitting it to lie in the field long enough to wilt (twelve hours' sunshine will be abundantly long), these tops and leaves become a valuable fuel and may be carried directly to the bagasse burner where they will aid in burning the expressed chips. In this way a large amount of fuel, now wasted, might be profitably used.

Again it is highly probable that a fan might be so con-

structed and geared that it would remove all of the green and immature parts of the cane with the trash and permit only the red matured joints to pass on to the comminutor. This supposition is based upon the marked differences in the specific gravities of the two parts of the cane and the analogous work performed by a first class wheat fan acting upon the same principle.

The expense of stripping and topping the cane for the mill is very great, while that of simply cutting the cane down is very small. The average cane *dried*, will give about 30 per cent of its weight in leaves and tops, and the only additional cost would be the labor of hauling to the sugar house this extra weight. Against this would be the fuel value of this trash and the diminished cost of harvesting the cane in the field. So feasible does all this appear, that no hesitancy is felt in predicting the day not far distant, when every diffusion plant will so treat cane, with a modified improvement, perhaps, of cutting it in the field by machinery instead of by hand as now.

October 14th—The Hughes cutter, designed for sorghum and which had performed most excellent work on this plant, was to-day given a fair trial on cane. The carrier, which heretofore reached within one foot of the cutter, in order to leave a space through which the heads of sorghum might fall, was now carried close up to the cutter. The work accomplished was however very unsatisfactory. The absence of a forced feed arrangement caused the canes, when they reached very short lengths, to be projected with force all over the sugar house, causing great loss and much annoyance. Three tons of second-year stubble were used in this experiment. The juice was clarified in the usual way, and sent through the filter press. The scums were returned to the battery. On account of the cutter doing its work badly, the comminutor failed to make fine chips, hence extraction was poor. It was therefore deemed best to send the entire juice into the double effect, cook to a thick syrup and run into wagons and let grain in the hot room. This was accordingly done and two days afterwards the masse cuite was centrifugalled, giving 358 pounds of sugar.

Mill juices of cane used gave—

Sucrose, 12.3 per cent.
Glucose, 1.78 per cent.
Fibre in cane, 12.96 per cent.

The Hughes cutter was at once supplanted by a small Ross ensilage cutter, which had been used for filling a silo at the State Experiment Station, Baton Rouge. This implement worked very satisfactorily the rest of the season, cutting easily the cane required by the diffusion battery.

October 17th—Diffused 4 tons second-year stubble. Knives worked well, but gave too large a chip, which was corrected on subsequent runs. For the first time clarification was tried in the cell. Milk of lime of density of 10° Baume was added to each cell, until by experiment a sufficient quantity was found to be present. Through insufficient heating surface in our calorisators, it was found impossible to heat the juice above 180°—200° F. Diffusion intermittent, giving twenty minutes to each cell. Two heaters leaked very badly, which caused an estimated loss of sugar of not less than 25 pounds. The process of clarification was a success. The juice, pure and clear, was sent directly to the double effect, and thence to vacuum pan.

SUGAR HOUSE RESULTS.

Cane diffused, 4 tons. Chips to each cell, 347 pounds. Percentage of trash removed, 4.3 per cent. Time of diffusion to each cell, 20 minutes.

Yield—1st sugars, 532. lbs.
2d sugars, 180.8 lbs.
3d sugars, 52.8 lbs.

Total 765.6 lbs., or 191.4 pounds per ton cane.

LABORATORY ANALYSES.

	Sucrose.	Glucose.	Glucose Ratio.
Diffusion chips	.8	.12	15.00
Mill juice	11.9	1.71	14.37
Diffusion juice	7.1	1.23	17.32
Syrup	38.7	5.90	15.50
First sugar	95.3	2.07	2.17
Second sugar	74.3	10.00	13.95
Third sugar	73.9	11.62	15.72
First molasses	42.9	10.16	23.91
Second molasses	30.3	23.66	78.08
Third molasses	29.3	31.64	107.98

CHEMICAL CONTROL.

Summary—Reduced to pure sugar:

532 lbs. 1st sugar @ 95.3..505.99
180.8 lbs. 2d sugar @ 74.3..134.33
52.8 lbs. 3d sugar @ 73.9.. 39.02

680.34 or 170.08 lbs. pure sugar per ton of cane.

The fibre in above was 12.87 per cent. The juice 87.13 per

cent. The total sugar in juice is 207.4 pounds per ton. Of this amount about 14 pounds were left in the chips. Of the remainder 193.4 pounds, there was recovered in pure sugar 170 pounds—leaving 23 pounds per ton unrecovered. In the masse cuite on hand there is about 17 pounds sucrose per ton—indicating a loss by leaks of about 6 pounds sugar per ton of cane worked. Here the 3d molasses contains a larger amount of Glucose than Sucrose, yet the masse cuite made from it is now crystallized in the hot room.

October 20th—Diffused 3 tons of second-year stubble. Improvised a measuring tank. Time of diffusion 10 minutes. Heaters still leaking and an unknown loss of juice occurred. Calcic clarification in the cells. Juice sent at once to double effect. No third sugar made.

SUGAR HOUSE RESULTS.

Cane diffused, 3 tons. Chips to each cell, 332 pounds. Percentage of trash. 3.4 per cent. Time of diffusion to each cell, 10 minutes.

Yield—1st sugar, 414. lbs.
2d sugar, 104.4 lbs.

Total. .518.4 lbs., equal to 172.8 lbs. per ton.

LABORATORY ANALYSES.

	Sucrose.	Glucose.	Glucose Ratio.
Diffusion chips	.55	.075	13.63
Mill juice	11.60	1.52	13.10
Diffusion juice	7.20	.93	12.91
Syrup	45.40	5.89	13.29
First sugar	92.00	2.63	2.86
Second sugar	77.30	9.44	12.21
First molasses	40.80	10.41	25.51
Second molasses	27.30	20.83	76.30

CHEMICAL CONTROL.

Summary—Reduced to pure sugar:

414 lbs. 1st sugar, @ 92 . .380.88
104.4 lbs. 2d sugar, @ 77.3. . 80.70

Total.........461.58, or 153.86 lbs. per ton.

There were in one ton of the above cane (10.5 per cent fibre and 89.5 per cent juice) 210 pounds fibre and 1790 pounds juice. The latter contained 11.60 per cent sugar=207.6 pounds per ton. Of this amount about 10 pounds were left in the chips—leaving 197.80 pounds in the juice. Of this there was recovered in dry sugar 153.86 pounds—leaving 43.94 pounds to be accounted for.

The third molasses contained 16 pounds only, showing our heaters had lost juice containing about 28 pounds sugar per ton of cane worked.

October 25th—Diffused 4 tons second-year stubble. Calcic clarification in cell. Increased the density of milk of lime used, to 13° B, using the same measure for each cell. Knives worked admirably and the juice very clean. Leaks in the heaters partially stopped by back pressue of steam.

SUGAR HOUSE RESULTS.

Cane diffused, 4 tons. Chips to each cell, 383 pounds. Percentage of trash, 5.9 per cent. Time of diffusion to each cell, 20 minutes.

Yield—1st sugar, 504 lbs.
2d sugar, 132 lbs.
3d sugar, 32 lbs.
4th sugar, 28 lbs.

Total..696, or 174 lbs. per ton of cane.

LABORATORY ANALYSES.

	Sucrose.	Glucose.	Glucose Ratio.
Diffusion chips	.53	.096	18.11
Mill juice	11.20	1.36	12.14
Diffusion juice	9.30	1.12	12.04
Syrup	40.40	4.80	11.88
First sugar	95.60	1.49	1.55
Second sugar	81.70	5.88	7.19
Third sugar	74.30	11.36	15.28
Fourth sugar	66.11	——	——
First molasses	——	——	——
Second molasses	34.20	23.66	69.18
Third molasses	28.30	31.25	110.40
Fourth molasses	——	——	——

CHEMICAL CONTROL.

Summary—reduced to pure sugar:

504 lbs. sugar @ 95.60..481.82 lbs.
132 lbs. sugar @ 81.70..107.84 lbs.
32 lbs. sugar @ 74.30.. 23.77 lbs.
28 lbs. sugar @ 65.4 .. 18 59 lbs.

Total..........632.02 lbs. or 158 lbs. pure sugar per ton of cane.

The fibre in this cane was 11.5 per cent. The juice in a ton of cane is therefore 1770 pounds and contains 11.20 per cent sucrose. This gives 198.24 pounds sugar to the ton, of which 10 pounds were left in the chips. Of the remaining 188 pounds 158 pounds were extracted as dry sugar, leaving 30 pounds per ton in the masse cuite or lost by leakage or overflow.

October 27th—Diffused 4 tons second-year stubble. Calcic clarification in cells. After liming each cell, the juice was tested

through a small pet cock leading from each cell. Up to date it was found that the worst extraction occurred in the beginning of the work—due to the difficulty of heating up the cells at the start. To-day special attention was given to the first cells and they were kept quite hot. Leaks still in the heaters.

SUGAR HOUSE RESULTS.

Cane diffused, 4 tons. Chips to each cell, 353 pounds. Percentage of trash 3.4 per cent. Time of diffusion to each cell, 10 minutes.

Yield—1st sugar, 537.6 lbs.
2d sugar, 156. lbs.
3d sugar, 20. lbs.
4th sugar, 17. lbs.

Total.. 730.6 lbs., or 182.6 lbs. per ton.

LABORATORY ANALYSES.

	Sucrose.	Glucose.	Glucose Ratio.
Diffusion chips	0.6	.079	13.16
Mill juices	11.60	1.14	9.82
Diffusion juices	8.40	.80	9.52
Syrup	43.40	4 38	10.09
First sugar	97.20	1.00	1.03
Second sugar	84.30	4.13	4.89
Third sugar	87.50	4.79	5.47
Fourth sugar	75.10	6.66	8.87
First molasses	49.7	13.88	27.72
Second molasses	31.2	17.60	56.
Third molasses	32.7	26.00	79.51
Fourth molasses	——	——	——

CHEMICAL CONTROL.

Summary—Reduced to pure sugar:

537.6 lbs. 1st sugar, @ 97.20..522.55
156 lbs. 2d sugar, @ 84.3 ..131.51
20 lbs 3d sugar, @ 87.5 .. 17.50
17 lbs. 4th sugar, @ 75.10.. 12.77

Total............684.23, or 171.08 lbs. per ton of cane.

The fibre in above is 11.4 per cent. The juice is 88.60 per cent. In the juice there is a possible 205½ pounds sugar for each ton of cane. There were left in the chips about 10½ pounds. Of the remainder, 195 pounds, there were recovered in pure sugar 171 pounds, leaving 24 pounds unrecovered. Since no analysis was made of the fourth molasses it is impossible to tell how much of this was lost by leaking.

October 30th—Diffused 5 tons second-year stubble. Calcic clarification in cells. Leaks still in heaters. Everything else worked satisfactorily.

SUGAR HOUSE RESULTS.

Cane diffused, 5 tons. Chips to each cell, 319 pounds. Percentage of trash, 3.1 per cent. Time of diffusion to each cell, 10 minutes.

Yield—1st sugar, 671 lbs.
2d sugar, 175 lbs.
3d sugar, 118.3 lbs.

Total..964.3 lbs.

LABORATORY ANALYSES.

	Sucrose.	Glucose.	Glucose Ratio.
Diffusion chips	.59	.05	8.48
Mill juice	12.9	.90	6.98
Diffusion juice	——	——	——
Syrup	42.7	2.89	6.76
First sugar	95.8	1.08	1.12
Second sugar	82.3	3.52	4.27
Third sugar	71.5	13.52	18.91
First molasses	51.3	9.61	16.66
Second molasses	38.1	13.89	36.45
Third molasses	35.	17.88	51.08
First sugar, washed	98.7	.08	.08

CHEMICAL CONTROL.

Summary—Reduced to pure sugar:

671 lbs. 1st sugar @ 95.8..642.82 lbs.
175 lbs. 2d sugar @ 82.3..144.02 lbs.
118.3 lbs. 3d sugar @ 71.5.. 84.58 lbs.

Total ....871.42 or 174.28 lbs. per ton.

The fibre in cane was 11.25 per cent. In a ton of cane there were 225 pounds of fibre and 1,775 pounds juice. The latter contained 228.9 pounds sugar, of which about 11 pounds were left in the chips, leaving 217.9 pounds in the juice extracted. Of this, 174.28 pounds have been secured as pure sugar and the remainder, about 43 pounds, is still either in the masse cuite or lost through the heaters. Here the dry sugar obtained is only 76 per cent of sugar in cane and 80 per cent of that extracted in the juice.

November 1st—Diffused 6 tons of second-year stubble. Calcic clarification in cells. Leaks in heaters for the *first time* effectually checked by back pressure. Heretofore the battery had been worked upon the intermittent plan—i. e., of letting into each cell the juice and permitting it to remain there for a given length of time. To-day we begun a continuous current through the battery, so arranged as to permit the emptying and

filling of a cell every ten minutes. Heretofore the dilution has been great. To-day there was drawn 350 pounds juice from 338 pounds chips—leaving .6 per cent sucrose in latter—making a concentrated diffusion juice. In winding up the battery 50 to 55 gallons of juice and washings were drawn from each cell. *The entire experiment a great success.*

SUGAR HOUSE RESULTS.

Cane diffused, 6 tons Chips to each cell, 338 pounds. Percentage of trash, 3.8 per cent. Time of filling and emptying cell, 10 minutes.

Yield—1st sugar, 1004.4 lbs.
2d sugar, 205.2 lbs.
3d sugar, 234.0 lbs.

Total..1443.6 lbs., or 240.6 lbs. per ton.

LABORATORY ANALYSES.

	Sucrose.	Glucose.	Glucose Ratio.
Diffusion chips	0.6	.05	8.33
Mill juice	13.50	.89	6.59
Diffusion juice	9.80	.72	7.34
Syrup	22.30	1.89	8.47
First sugar	95.30	1.01	1.06
Second sugar	95.50	.53	.55
Third sugar	63.80	10.63	16.66
First molasses	47.60	11.90	25.00
Second molasses	38.20	15.62	40.89
Third molasses	29.50	19.84	68.72

CHEMICAL CONTROL.

Summary—Reduced to pure sugar:

1004.4 lbs. 1st sugar, @ 95.3.. 957.19
205.2 lbs. 2d sugar, @ 95.5.. 187.76
234 lbs. 3d sugar, @ 63.8.. 149.29

Total............1294.24, or 215.70 lbs. per ton.

Fibre in above 10.30 per cent. Leaving juice 89.70 per cent. This gives a possible sugar of 241 pounds to ton. There was left in the chips about 10¾ pounds. Of the remainder, 230¼ pounds, there was recovered in dry sugar 215.7 pounds—leaving about 14½ pounds in the masse cuite per ton of cane worked. There is by analysis in the masse cuite now in the hot room a little over 15 pounds sucrose for each ton of cane worked, a close agreement between theory and practice.

November 7th—After a delay of several days to repair heat-

ers, diffused this day 7 tons first-year stubble. Continuous current through the battery, filling and emptying a cell every ten minutes. Calcic clarification in cells. Heat used very low and extraction poor, leaving .8 per cent sucrose in chips. Dilution moderate, drawing 400 pounds juice from 340 pounds cane.

SUGAR HOUSE RESULTS.

Cane diffused, 7 tons. Chips to each cell, 340 pounds. Percentage of trash, 5 per cent. Time of filling and emptying cells, 10 minutes.

Yield—1st sugar, 1148 lbs.
2d sugar, 266 lbs.
3d sugar, 168 lbs.

Total..1582 lbs., or 226 lbs. per ton.

LABORATORY ANALYSES.

	Sucrose.	Glucose.	Glucose Ratio.
Diffusion chips	0.8	.55	6.87
Mill juice	13.29	.82	6.17
Diffusion juice	9.60	.59	6.14
Syrup	38.80	2.47	6.36
First sugar	95.50	1.35	1.41
Second sugar	80.90	8.00	9.88
Third sugar	——	——	——
First molasses	47.10	11.90	25.20
Second molasses	38.70	16.12	41.65
Third molasses	——	——	——

Fibre in above cane 14.56 per cent. Juice 85.44 per cent. In one ton of cane there were 227 pounds pure sugar. Of this amount about 14 pounds were left in chips. Leaving 213 pounds pure sugar in the juice. The analyses of third sugar was overlooked and therefore no accurate determination of the pure sugar obtained, can be made. Enough is known, however, to show that it exceeded 200 pounds, leaving only a small percentage in the molasses. There was no loss to-day from leaks. The high fibre percentage and low extraction accounts for apparently low sugar results.

November 9th—Diffused 6 tons of first-year stubble. Calcic clarification in cells. Continuous current through battery discharging every ten minutes. Diffusion juice very concentrated, containing nearly 11 per cent sucrose. Drew off 348 pounds juice for 340 pounds cane, or a mill dilution of about 16 per cent. Extraction poor. Chips too coarse.

SUGAR HOUSE RESULTS.

Cane diffused, 6 tons. Chips to each cell, 340 pounds. Percentage of trash, 3.5 per cent.

Yield—1st sugar,	966	lbs.
2d sugar,	174	lbs.
3d sugar,	115.8	lbs.

Total sugar..1255.8 lbs. or 199.3 lbs. per ton.

LABORATORY ANALYSES.

	Sucrose.	Glucose.	Glucose Ratio.
Diffusion chips	1.0	.07	7.00
Mill juice	13.10	.64	4.88
Diffusion juice	10.60	.49	4.62
Syrup	40.60	1.81	4.95
First sugar	95.00	1.05	1.10
Second sugar	92.70	1.19	1.28
Third sugar	87.40	2.25	2.57
First molasses	53.90	7.14	13.24
Second molasses	40.50	12.50	30.86
Third molasses	39.40	16.18	41.06

*

CHEMICAL CONTROL.

Summary—Reduced to pure sugar:

906 lbs. 1st sugar @ 95.	860.7	lbs.
174 lbs. 2d sugar @ 92.7	161.3	lbs.
115.8 lbs. 3d sugar @ 87.4	101.21	lbs.

Total..........1123.21, or 187.2 lbs. per ton of cane.

Fibre in above 10.88 per cent. Juice 89.12 per cent. In one ton of cane there was 233½ pounds sugar. About 18 pounds were left in chips, giving 215½ to the extracted juice. Of this amount 187.2 pounds have been recovered in pure sugar, leaving about 28 pounds in the masse cuite, which is fully sustained by chemical analysis.

November 12th—Diffused 5 tons first-year stubble. Concentrated diffusion juice. Comminutor sharp and chips fine. Rich cane and everything worked well. Calcic clarification in cells with heat well maintained at 200° F. Continuous current through battery discharging every ten minutes 40 gallons juice.

SUGAR HOUSE RESULTS.

Cane diffused, 5 tons. Chips to each cell, 312 pounds. Percentage of trash, 4.3 per cent.

Yield—1st sugar,	838	lbs.
2d sugar,	269	lbs.
3d sugar,	147.5	lbs.

Total..1251.5 lbs., or 250.9 lbs per ton.

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*The following are extracts from notes of Mr. Baldwin, who had charge of vacuum pan: "Syrup very clear, actually bright, reminding one of sulphured juices in regular mill work. Very little foaming; heat 140°—150° F."

LABORATORY ANALYSES.

	Sucrose.	Glucose.	*Glucose Ratio.
Diffusion chips	.54	——	——
Mill juice	14.50	.54	3.72
Diffusion juice	11.30	.37	3.27
Syrup	37.00	1.52	4.10
First sugar	97.20	.53	.54
Second sugar	87.30	——	——
Third sugar	77.50	3.33	4.18
First molasses	50.10	6.49	12.95
Second molasses	41.60	——	——
Third molasses	——	——	——

*

CHEMICAL CONTROL.

Summary—Reduced to pure sugar:

838 lbs. 1st sugar, @ 97.20.. 814.54
269 lbs. 2d sugar, @ 87.30.. 234.84
147.5 lbs. 3d sugar, @ 77.50.. 114.31

Total.............1163.68, or 232.74 lbs pure sugar per ton cane.

The fibre in the above cane was 9.6 per cent. In the 5 tons cane there were 960 pounds fibre and 90.40 pounds juice. The juice contained 14.50 per cent sucrose=1310.8 pounds. There was left in the chips about 50 pounds, giving 1260.8 pounds sugar in juice extracted. Of this amount 1163.70 pounds were extracted as dry sugar and the remainder 9.7 pounds is now in the 4th masse cuite in the hot room—a part of which we hope to secure as sugar during the summer. The extraction here was about 96 per cent of the sugar present, and the dry sugar obtained was over 88 per cent of that in the cane and 92 per cent of that in the juice extracted. There were 48.81 pounds glucose in the cane worked—of which 8 pounds were left in the chips and about 12 pounds removed in the sugar, leaving about 28 pounds in the masse cuite. There is at least 60 pounds of sugar still available in the masse cuite.

November 14—Diffused 8 tons first-year stubble. Calcic clarification in cells. Constant current with good heat. Drew off 430 pounds juice for every 345 pounds cane. Knives of comminutor dull.

NOTES BY MR. BALDWIN.

* "Tried to heat battery in advance of filling on first round, but did not do much good. Grained in the pan very well; heat 150°—160° F."

SUGAR HOUSE RESULTS.

Cane diffused, 8 tons. Chips to each cell, 345 pounds. Percentage of trash, 3.5 per cent.

Yield—1st sugar, 1252.8 lbs.
2d sugar, 316 lbs.
3d sugar, 120 lbs.

Total..1688.8 lbs. or 211.1 lbs. per ton.

LABORATORY ANALYSES.

	Sucrose.	Glucose.	Glucose Ratio.
Diffusion chips	1.1	.07	6.36
Mill juice	12.9	.88	6.82
Diffusion juice	9.8	.59	6.02
Syrup	39.1	2.77	7.08
First sugar	95.0	1.40	1.47
Second sugar	74.6	7.57	10.14
Third sugar	80.3	6.37	7.93
First molasses	51.8	10.63	20.56
Second molasses	36.4	14.28	39.23
Third molasses	23.7	15.15	63.92

CHEMICAL CONTROL.

Summary—Reduced to pure sugar:

1252.8 lbs. 1st sugar @ 95 ..1190.16
316 lbs. 2d sugar @ 74.6.. 235.74
120 lbs. 3d sugar @ 80.3.. 96.36

Total..........1522.26, or 190.28 lbs. per ton cane.

Fibre in above 10.65 per cent. Juice, 89.35 per cent. In one ton of cane were 230½ pounds pure sugar. Of this amount about 20 pounds were left in chips. Of the remainder, 210½ pounds, there were recovered in pure sugar 190.28 pounds, leaving about 20 pounds, of which about 10 pounds is found by analyses in the masse cuite and the remainder unaccounted for.

November 16—Diffused 3 tons first-year stubble. Limed to neutrality in the cells. Continuous current drawing off 437 pounds of juice to 374 pounds chips in every ten minutes. Knives sharp; chips finest to date. Heat high and extraction good, leaving only .7 per cent sucrose in chips. Everything worked well and juice very pure.

SUGAR HOUSE RESULTS.

Cane diffused, 3 tons. Chips to each cell, 374 pounds. Percentage of trash, 3.8 per cent.

Yield—1st sugar, 454.2 lbs.
2d sugar, 76.5 lbs.
3d sugar, 54.0 lbs.

584.7 lbs., or 194.9 lbs. per ton.

LABORATORY ANALYSES.

	Sucrose.	Glucose.	Glucose Ratio.
Diffusion chips	.7	.06	8.57
Mill juice	11.6	1.01	8.71
Diffusion juice	9.1	.76	8.57
Syrup	31.3	2.67	8.53
First sugar	90.6	1.88	2 07
Second sugar	78.5	5.26	6.70
Third sugar	80.2	——	——
First molasses	55.0	11.36	20.65
Second molasses	44.3	13.33	30.09
Third molasses	32.	15.62	48.81

CHEMICAL CONTROL.

Summary—Reduced to pure sugar:

454.2 lbs. sugar @ 90.6..411.50
76.5 lbs. sugar @ 78.6.. 60.05
54 lbs. sugar @ 80.2.. 43.31

Total.........514.86, or 171.62 lbs. per ton of cane.

The above experiment was made with nine distinct varieties of cane. No determination of fibre was made. Assuming it at 11 per cent, there would be in a ton of cane 206 pounds sugar. Of this amount about 13 pounds were left in the chips, giving to the juice worked about 193 pounds sugar per ton. Of this amount 171.6 pounds were covered in pure sugar—leaving 21.4 pounds unrecovered. Analysis shows one masse cuite now in the hot room to have a little over 19 pounds sucrose per to of cane worked, and therefore our assumption of percentage of fibre is not far wrong.

November 20th—Diffused 9 tons first year stubble. The fan was broken and hence in this run the chips were only partially cleaned. Calcic clarification in cells. Continuous current, discharging a cell every fifteen minutes. Drew off 432 pounds juice from 378 pounds chips.

An attempt was here made to decolorize the juice by passage through a small quantity of boneblack. Nearly 8 pounds of freshly burnt and coarsely pulverized boneblack was used to filter this run through. A molasses barrel with holes in the true bottom, was fitted with a false and open bottom, two inches above the former, and upon this was spread an open coarse blanket and in this blanket was deposited the boneblack. Through this boneblack, the juice as emptied from each cell,

percolated, at first very rapidly, but towards the close of the day very slowly. No perceptible effect was observed by passage through so small a quantity of boneblack and hence the experiment was discontinued.

SUGAR HOUSE RESULTS.

Canes diffused, 9 tons. Chips to each cell, 378 pounds. Percentage of trash, ——.

Yield—1st sugar, 1429.2 lbs.
2d sugar, 361.8 lbs.
3d sugar, 108.0 lbs.

Total..1899.0 lbs., or 211 lbs. per ton.

LABORATORY ANALYSES.

	Sucrose.	Glucose.	Glucose Ratio.
Diffusion chips	.8	.07	8.75
Mill juice	11.46	.96	8.37
Diffusion juice	9.00	.72	8.00
Syrup	38 20	2.89	7.59
First sugar	92.20	1.84	1.99
Second sugar	73.	7.04	9.64
Third sugar	78.8	6.25	7.93
First molasses	50.8	11.62	22.28
Second molasses	41.5	17.85	43.01
Third molasses	27.20	21.50	79.04

CHEMICAL CONTROL.

Summary—Reduced to pure sugar.

1429 2 lbs. 1st sugar @ 92.2..1317.72
361.8 lbs. 2d sugar @ 73. .. 264.11
107. lbs. 3d sugar @ 78.8.. 85.10

Total.............1666.93, or 185.21 lbs. per ton.

Fibre 9.65 per cent and juice 90.35 per cent in above cane. One ton of cane therefore contained 207 pounds pure sugar. There were left in the chips about 14 pounds sugar. Of the remainder, 193 pounds, there were recovered about 185 pounds—leaving 8 pounds per ton in the masse cuite. There is in the hot room masse cuite from 270 pounds molasses, which has according to above analysis 27.20 per cent sucrose. This would give 73.44 pounds sucrose for the nine tons, or 8.16 pounds per ton—quite a satisfactory agreement.

DIFFUSION OF BAGASSE FROM A FIVE-ROLLER MILL.

November 22d—Six thousand seven hundred and eighty-five pounds bagasse were taken directly from a five-roller mill,

which was doing fairly good work, and diffused. By slight adjustments the knives and comminutor were made to work quite well and a tolerably fine chip was made. The above amount of bagasse filled 53 cells after packing each cell vigorously with a 2x5 scantling, 4½ feet long. Clarification was performed in the cells by addition of lime and quite a clear juice obtained, which was evaporated in the double effect and then grained in the vacuum pan. There was obtained 134.6 pounds of first sugar.

The molasses was boiled to string and put in the hotroom where it remained three days. It was centrifugalled and gave 32.7 pounds per ton. This will make 167.3 pounds to the ton of bagasse.

The bagasse gave a very diluted juice containing only 3 per cent. sucrose, while a similar quantity of juice drawn from each cell of cane with 14 per cent. sucrose showed as high as 10.7 per cent. In both instances 40 gallons of juice were drawn from each cell—the one from 128 pounds bagasse, the other from 342 pounds cane. The extraction of sugar from the bagasse was more complete, leaving on an average about .15 per cent. in the chips to .74 in those of the cane. Here we have two experiments made on consecutive days. The first day upon 18,862 pounds of cane, filling 52 cells, giving a volume of juice containing 10.7 per cent. sucrose. The next day 6785 pounds of bagasse, filling 53 cells, giving a similar volume of juice containing only 3 per cent. sucrose. This diluted juice had to be evaporated to about one-third of its volume before it equalled the original juice from the cane. We filled 53 *cells;* while an experiment made the day previous showed that 18.862 pounds cane filled only 52 *cells.*

The bagasse contained 9 per cent. sucrose and 1.01 glucose. The clarification was good, but there was extracted a large quantity of soluble solids, not sugar, which in concentration were very sticky and objectionable, hindering perfect purging. The sugar, therefore was not thoroughly cleansed, and accordingly only polarized 90°. It was grained slowly in the pan at a low temperature—140° to 150° F. The masse cuite was quite gummy, but analysis showed the molasses to contain 41.7 per cent. sucrose and 7.87 per cent. glucose. This molasses contained a con-

siderable quantity of solids, not sugar, insoluble in alcohol. But the most notable feature in this experiment is the small quantity by weight of bagasse which each cell contained, packed as tightly as we could, only 128 pounds, against 340 to 390 of cane chips. In this experiment of 6785 pounds bagasse we could not draw a more concentrated juice without endangering our extraction. It therefore seems utterly impracticable from this experiment to diffuse bagasse: 1st. Since it appears to require same size battery and same time for its diffusion as the original cane. 2d. It gives about an equal volume of juice as the cane, of only about one-third the density; and, 3d, it extracts proportionately far more impurities, and therefore gives an inferior sugar, with many hindrances to crystalization and purging. A battery sufficiently large to work up the bagasse from a five-roller mill will doubtless work up with greater ease and in the same time the original cane.

The following is the pure sugar obtained:

134.6 lbs. 1st sugar @ 90 ..121.14 lbs.
32.7 lbs. 2d sugar @ 85.1.. 27.82 lbs.

Total pure sugar per ton....148.96 lbs.

November 24th—Diffused 7 tons plant cane. Calcic clarification in cells. Constant current through battery—discharging cell every ten minutes. Heat at first deficient. Comminutor dull and chips very badly cut. Extraction therefore poor. Syrup cooked slowly in vacuum pan at 130–140° F.

SUGAR HOUSE RESULTS.

Cane diffused, 7 tons. Chips to each cell, 390 pounds. Percentage of trash, 2.4 per cent.

Yield—1st sugar, 1022 lbs.
2d sugar, 203 lbs.
3d sugar, 63 lbs.

Total..1288 lbs, or 184 lbs. per ton.

LABORATORY ANALYSES.

	Sucrose.	Glucose.	Glucose Ratio.
Diffusion chips	1.1	.09	8.20
Mill juice	12.2	1.00	8.19
Diffusion juice	8.7	.67	7.70
Syrup	45.1	3.44	7.62
First sugar	93.8	1.92	2.04
Second sugar	90.0	1.72	1.91
Third sugar	85.9	4.67	5.43
First molasses	45.	10.86	24.13
Second molasses	36.4	14.20	39.01
Third molasses	30.8	19.19	62.30

CHEMICAL CONTROL.

Summary—Reduced to pure sugar:

1022 lbs. of sugar @ 93.8	..	958.64
203 lbs. of sugar @ 90.	..	182.7
63 lbs. of sugar @ 85.9	..	54.12

Total..........1195.46, or 170.78 lbs. per ton of cane.

Fibre in above, 10.46 per cent. Juice 89.54 per cent. One ton of cane contains 218.5 pounds pure sugar. Of which there remain in the chips about 20 pounds, leaving 198 pounds in the juice. There were recovered in pure sugar 170.78 pounds, leaving 17.22 pounds to be accounted for. In the masse cuite in sugar house, there is by analyses 15.1 pounds sucrose per ton of cane worked—leaving only 2 pounds per ton unaccounted for.

November 26th—Diffused 8 tons plant cane. Thermometers of accuracy received and used to-day for the first time. Ran juice when filling through two heaters into bottom of next cell in order to get up requisite heat and found it worked so well that it was afterwards followed. Constant current discharging cell every nine minutes. Calcic clarification in cell. Pulp very good.

SUGAR HOUSE RESULTS.

Cane diffused, 8 tons. Chips to each cell, 396 pounds. Percentage of trash, 3.2 per cent.

Yield—1st sugar, 1424.8 lbs.
2d sugar, 344 lbs.
3d sugar, 152 lbs.

Total..1920.8 lbs., or 240.1 lbs. per ton.

LABORATORY ANALYSES.

	Sucrose.	Glucose.	Glucose Ratio.
Diffusion chips	.4	——	——
Mill juice	12.9	.58	4.83
Diffusion juice	9.9	.48	4.84
Syrup	42.2	2.50	5.92
First sugar	96.1	.85	.88
Second sugar	85.5	1.81	2.11
Third sugar	79.4	4.92	6.19
First molasses	50.8	8.22	16.18
Second molasses	38.1	12.50	32.80
Third molasses	29.0	16.94	58.41

CHEMICAL CONTROL.

Summary—Reduced to pure sugar:

1424.8 lbs. 1st sugar @ 96.1	..	1369.23
344 lbs. 2d sugar @ 85.5	..	244.12
152 lbs. 3d sugar @ 79.4	..	120.68

Total ....1734.03, or 216.75 lbs. per ton of cane.

Fibre in above, 10.22 per cent. Juice, 89.78 per cent. In one ton of cane there were 231.63 pounds pure sugar. There were left in the chips about 7 pounds. Of the remaining 224.63 pounds there were recovered in pure sugar 216.75 pounds, leaving about 8 pounds in the masse cuite now in sugar house. Chemical analysis shows the latter to contain about 15 pounds of sucrose per ton of cane worked—giving an unaccountable excess over theory of 7 pounds to the ton.

LIQUID SULPHUR DIOXIDE.

December 1st.—In November there appeared in the Louisiana Planter and Sugar Manufacturer of New Orleans, the following:

SULPHUROUS ACID.

A NEW METHOD FOR ITS APPLICATION TO SUGAR SOLUTIONS.

We quote from *Sugar* a report of a general meeting of the Association of German Sugar Manufacturers, to which a report was made on the employment of gaseous and liquid sulphurous acid in the sugar factory, which will be of especial interest to our readers now, as we have so recently had the matter discussed before the Louisiana Sugarplanters' Association. The new method seems to largely, if not entirely, avoid inversion, which is the common fault with our present use of gaseous sulphurous acid.

Mr. D. D. Colcock, the enterprising secretary of the sugar exchange has taken the matter in hand, and is now endeavoring to arrange for a complete test at the sugar experiment station, in order that we may see whether or not we can be as successful as our German cousins seem to have been. The report was as follows:

In the ordinary mode of preparing gaseous sulphurous acid the percentage of actual acid obtained is but small. In fact it is prepared by burning sulphur in atmospheric air supplied to it by a force pump. Ordinary air contains about 21 per cent. of oxygen to 79 per cent. of nitrogen, and the sulphurous acid gas thus produced is therefore very much contaminated with nitrogen.

The employment of sulphurous acid in the gaseous state presents also another inconvenience, for whenever it becomes necessary from any cause to interrupt the work of saturation the gas must be allowed to escape, as the force pump cannot be stopped, as, if so, the burning sulphur would be extinguished.

Again, the sulphurous acid gas thus obtained always contains certain impurities, such as a little sulphuric acid, and some sublimed sulphur, which often attack or obstruct the pipes.

For a long time past sulphurous acid has been produced in

the liquid form, but its high cost was an obstacle to its use in the sugar. A zinc manufacturing company at Oberhausur, near Dusseldorf, now produces liquid sulphurous acid in a very pure condition and at a very low price. The liquid is sold at $3 per 220 pounds, and as the product is pure it contains 50 per cent. of sulphur. Now 220 pounds of sulphur cost $2.50 to $2.75, and hence sulphur in the form of liquid acid can be bought for a little over twice the price of sulphur burned in air.

The liquid sulphurous acid is forwarded in cast-iron vessels, and its conveyance presents no difficulties. The vessel containing it is fitted with a valve, which enables the rate at which the gas passes into the juice treated to be regulated at pleasure, and stopped or started at any moment.

The concentrated gas does not attack the pipes. It is well known that sulphurous acid is not corrosive so long as it remains anhydrous.

Experiments have been made to see whether sulphurous acid in this new form inverted sugar as some have feared. The experiments have been made in two ways: 1st. The vessel containing the liquid acid has been placed above the saturator, and the liquid acid has been allowed to run into the juice. 2d. The vessel of liquid acid has been placed below the opening of the saturator, and the acid was thus made to reach the juice in the form of gas. In the first case the saturation was effected in from 3 to 7 minutes; in the second case in 17 minutes. When the acid was added in the liquid state it always inverted a little sugar, but this did not happen when the gas acted in the gaseous condition. The comparative effects of the two modes of employing liquid sulphurous acid may be stated thus:

	Position of vessel of liquid acid in relation to the saturator	
	Above Liquid Acid.	Below Gaseous Acid.
Time required for saturation after opening the valves, in minutes	3 to 7	17
Reduction of color	74 to 90	48 to 87
Reduction of ash, calculated on the dry matter present	1.14 to 1.26	1.08 to 1.30
Improvement in co-efficient purity	1 per cent.	2 per cent.
Inverted sugar produced	a little.	not a trace.

If we can buy liquid sulphurous acid in transportable form it is better to use it in the second manner—that is, to place the vessel of acid below the saturator, so as to compel the acid to enter in the form of gas. The purification will then proceed with more energy, and there will be no production of inverted sugar.

A few days after the appearance of this article, Mr. Colcock secured through the kindness of Mr. J. M. Winship, President New Orleans Cold Storage Company, 75 pounds of the liquefied sulphurous acid gas (known chemically as Sulphur Dioxide) in its anhydrous state and after having it securely packed in a

copper flask, shipped to the Station for experimental purposes. The first experiment was made December 1st. Eleven thousand four hundred and ninety-four pounds of cane were used; clarification in cells of diffusion battery by use of lime; each clarifier of juice treated with sulphur, by permitting the liquid dioxide to volatilize through a pipe attached to the carboy, and provided with an ordinary stop-cock for regulating the flow. The gas passed into the juice at the bottom of the clarifier. When the juice had reached a clear amber tint the cock was shut and the gas cut off. Lime was then added not quite to neutrality, the juice carefully brushed and settled; brushings and settlings returned to the diffusion cells. The clear juice, with bright amber tint, was concentrated in the double effect and grained in the vacuum pan at 130 to 140° F, with the following

SUGAR HOUSE RESULTS.

806 pounds first sugar, or 140 pounds per ton of cane.
1041 pounds first molasses, or 181 pounds per ton of cane.
535 pounds second molasses, or 91 pounds per ton of cane.
338½ pounds second sugar, or 58 pounds per ton of cane.
113 pounds third sugar, or 20 pounds per ton of cane.
277 pounds third molasses, or 48 pounds per ton of cane.
Total sugar per ton, 218 pounds.

The following shows the carefully conducted chemical analyses at each stage of manufacture:

LABORATORY ANALYSES.

	Sucrose.	Glucose.	Glucose Ratio.
Diffusion juice before sulphuring	9.5	.60975	6.418
Diffusion juice after sulphuring	9.4	.70975	6.486
Diffusion juice after liming and brushing	9.6	.62500	6.511
Syrup	31.6	2.0000	6.330
Sugar	98.6	.14	——
Molasses	46.6	8.33	——
Masse cuite	69.2	5.30	7.659

In the above there was a small but steady increase in the glucose ratio everywhere, except in the double effect, where there was a slight decrease. We had been cooking string sugar the day before in the second effect, some of which grained therein. The vessel was steamed out, but not thoroughly washed, and it it may be that crystals of sugar adhering to the sides may have

been dissolved by the sulphured juice and increased its purity coefficient.

The following shows the loss sustained in the first cooking:

	Sucrose. Lbs.	Glucose. Lbs.	Sucrose. Lbs.	Glucose. Lbs.
In the diffusion juice were			1301	83.43
In the sugar obtained	794.71	11.28		
In the molasses	484.64	86.63		
			1279.35	97.91
Loss of sucrose			21.65	
Gain of glucose				14.48

This gain of glucose equals sucrose inverted, 13.76 pounds, leaving a balance of loss of sucrose (21.65—13.76) of 7.89 pounds unaccounted for.

Sucrose in cane worked, 12.57 per cent.

Glucose in cane worked, .78 per cent.

The juice and syrups treated thus behaved exactly like those treated with sulphur in the usual way. Yield per ton, first, second and third sugars, 218 pounds.

The conclusions arrived at are:

1st. That the inversion was reduced to a minimum.

2d. That the bleaching effect of the sulphur in this form quite equalled that gained in the ordinary way (sulphur stove and wash-barrel); and,

3d. That the application was far more simple and far less disagreeable, with *all* the benefits to be derived from bleaching.

An attempt to use this reagent in the diffusion cells was a disastrous failure. See beyond page.

December 6th—Diffused 5 tons of plant cane. Held to-day a public exhibition with large crowd of planters and others interested in sugar in attendance. Calcic clarification in cells. Continuous current through battery, discharging a cell every seven minutes. Discharge made from cell next to the last.

A clearer and bettter juice was thus obtained, with the dis-disadvantage only of decreasing the effectiveness of the battery by eliminating one cell. The valves were so arranged that the juice in going from cell to cell passed through two heaters, and when the last cell was filled, the valve beyond being closed, the juice from cell next to the last went over into the measuring

tank, leaving the juice in the last cell, as it were, dormant. By this process a much higher heat and a better clarification was obtained. The experiment was very satisfactory. The heaters, however, began again yesterday to leak, causing much annoyance, and continued troublesome through this experiment, causing a loss of about 14 pounds per ton.

SUGAR HOUSE RESULTS.

Cane diffused, 5 tons. Chips to each cell, 397 pounds. Percentage of trash, 2.8 per cent.

Yield—1st sugar, 600 lbs.
2d sugar, 360 lbs.
3d sugar, 75 lbs.

Total sugars..1035 lbs. or 207 lbs. per ton.

LABORATORY ANALYSES.

	Sucrose.	Glucose.	Glucose Ratio.
Diffusion chips	1.0	.07	7.00
Mill juice	13.3	.73	5.41
Diffusion juice	9.3	.59	6.34
Syrup	43.0	2.63	6.11
First sugar	99.1	.16	.161
Second sugar	82.1	4.13	5.03
Third sugar	83.2	5.01	6.02
First molasses	53.1	7.93	14.93
Second molases	42.3	12.19	28.81
Third molasses	31.1	17.88	57.49

CHEMICAL CONTROL.

Summary—Reduced to pure sugar:

600 lbs. 1st sugar @ 99.1..594.60
360 lbs 2d sugar @ 82.1..295.56
73 lbs. 3d sugar @ 83.2.. 60.74

Total..........950.90 or 190.18 lbs. per ton.

Fibre in cane 10.34 per cent. Juice, 89.66 per cent. One ton of cane contained 238 pounds pure sugar. There remained in the chips 18 pounds, leaving 220 pounds in the juice. Of this amount 190 pounds were recovered as pure sugar and there is in hot room in the masse cuite 16 pounds, leaving 14 pounds per ton to be charged to leaky heaters.

December 8th—Diffused 5 tons plant cane. Calcic clarification in cell. Continuous current through the battery, discharging from cell next to the last every 18 minutes. Heaters leaked very badly to-day.

SUGAR HOUSE RESULTS.

Cane diffused, 5 tons. Chips to a cell, 393 pounds. Percentage of trash, 2.6 per cent.

Yield—1st sugar, 680 lbs.
2d sugar, 210 lbs.
3d sugar, 110 lbs.

Total..1000, or 200 lbs. per ton of cane.

LABORATORY ANALYSES.

	Sucrose.	Glucose.	Glucose Ratio.
Diffusion chips	.5	.04	8.00
Mill juice	12.6	.88	6.98
Diffusion juice	.92	.66	7.17
Syrup	39.0	2.63	6.74
First sugar	94.2	1.31	1.39
Second sugar	79.2	3.54	4.46
Third sugar	72.8	7.14	9.80
First molasses	52.	9.09	17.48
Second molasses	52.7	14.70	32.16
Third molasses	23.5	17.24	73.35

CHEMICAL CONTROL.

Summary—Reduced to pure sugar:

680 lbs. 1st sugar @ 94.2..640.56
210 lbs. 2d sugar @ 79.2..166.32
110 lbs. 3d sugar @ 72.8.. 80.08

Total ....886.96, or 177.39 lbs. per ton

The above summary, together with sugar in the masse cuite in the hot room, indicate a loss of about 24 pounds sugar to the ton of cane due to leaky heaters.

ANALYSES OF JUICE AND CHIPS FROM EACH CELL OF BATTERY.

December 8th—On same day an experiment was made to test the question of the number of cells necessary for economical diffusion of sugar cane.

After the battery had gotten well under way, a stop was made and samples of juice from each cell was taken. The juice was then driven out of each cell and the chips taken and analyzed.

It must be remembered that in a battery of 14 cells only 12 are in constant use; the other two are being filled and emptied. Therefore at any given moment there are only 12 cells filled with juice. Below are the analyses. Some of the cells towards the end of the battery, where the juices were very weak, suffered

slightly by inversion, on account of delay in analyzing them. It required some hours before the analyses were completed. Hence, glucose ratios are somewhat increased to the last. In interpreting the analyses it should be remembered that cell No. 1 in this list was about to be emptied of juice and cell No. 12 about to be emptied of chips. The following results were obtained:

No. of Cell	Juice. Sucrose.	Juice. Glucose.	Chips. Sucrose.	Chips. Glucose.
1	9.0	.58	9.7	.65
2	6.6	.42	9.8	.56
3	5.6	.28	8.4	.55
4	3.9	.18	5.7	.34
5	3.4	.13	4.1	.29
6	2.8	.098	2.9	.19
7	1.0	.068	2.3	.14
8	.8	.052	1.7	.11
9	.5	.034	.9	.14
10	.4	.031	.7	.066
11	.3	——	.7	.05
12	.2	——	.6	.035

From the above it appears that the sugar is practically extracted in eight cells, since only a very small amount was extracted by the last four cells, and suggests that a battery with ten cells will be sufficient for economic diffusion of cane, provided clarification is not performed in the cell. If clarification be performed in the cell and the juice is drawn from the third cell from the last leaving two dormant cells, then twelve cells will perhaps be required.

EXPERIMENTS WITH CLARIFYING AGENTS.

December 11th—This day was devoted to the use of different agents, to test their efficacy in the manufacture of sugar.

The battery was charged as usual. Lime was used in slight excess in the cells. The juice drawn from the first 8 cells was used for experiments with

EHRMANNITE,

a favorite reagent with some tropical planters. This substance is a crude Phosphate and has an acid reaction. It produces a voluminous precipitate which settles slowly and carries down with it many impurities and a great deal of the coloring matter. This reagent was kindly donated by Col. C. M. Soria, President of Standard Guano and Chemical Works, of New Orleans.

The above mentioned juice was divided into two parts.

No. 1. The juice was clarified in the cells using a slight excess of lime. It was drawn around to the clarifier and there treated with a solution of Ehrmannite until it showed the slightest amount of acid by the use of blue litmus paper. It was then boiled and allowed to settle and carefully decanted. The clear liquid which was pure and but slightly improved in color, was concentrated to a thick syrup in an open pan. The following analyses show the results:

	Sucrose.	Glucose.	Glucose Ratio.
Diffusion juice	10.6	0.51	4.81
Syrup	55.6	2.76	4.96

Here the inversion was practically naught.

Experiment No. 2—The juice after calcic clarification in cell, was limed in great excess in the clarifier and heated to boiling. An excess of a solution of Ehrmannite was then added, again heated and then settled. The clear supernatant juice was then withdrawn and concentrated to a thick syrup in an open pan. This juice was quite acid and very bright in color. It made a beautiful and delicious syrup, which showed a considerable amount of inversion. The following are the analyses:

	Sucrose.	Glucose.	Glucose Ratio.
Diffusion juice	9.2	.66	7.17
Syrup	51.5	5.05	9.[illegible]0

From the above trials with Ehrmannite no decided benefits over our present methods of clarifying with sulphur and lime could be detected. In fact, juices must be worked neutral to prevent inversion, and any acidity must be avoided to secure the largest yield of sugar.

No attempt was made at making sugar with these small quantities of syrup and it was decided at some future time to give this reagent an extensive trial in sugar making, but no opportunity was presented this season and further trials were deferred till another year.

BISULPHITE OF LIME.

December 11th—After discharging eight cells in the usual way, with milk of lime in the cells, cell No. 9 before *filling* received the necessary amount of bisulphite of lime. It was filled with chips and milk of lime was added at the top. In this way many cells were filled. The juice drawn was quite clear and

bright, and hopes were entertained of a success, but after results proved the contrary. After concentration to syrup it was sent to the vacuum pan, where it was sticky, gummy and slow to grain. It had also a peculiar taste, and before completion had an intensely black color. It grained with slowness and centrifugalled with great difficulty, giving a very indifferent sugar. It was found upon examination that the acid bisulphite had extracted very obnoxions properties from the cane, which prevented graining in the pan and obstructing purging. This acid juice in its passage through iron cells and double effect blackened greatly. This experiment fully condemned this process. The following are analyses:

	Sucrose.	Glucose.	Glucose Ratio.
Diffusion juice	9.5	.62	6.52
Syrup	15 4	2.89	18.76
Sugar	92.0	2.35	2.55
Molasses	52.4	12.82	24.54

LIQUID SULPHUR DIOXIDE

was used on same day in the cell with very disastrous results. A tube was fitted to the receiver and its end inserted in the bottom of the cell of chips before liming, or sending in the juice from the adjoining cell; the stop-cock was turned and the gas turned in until it was perceptible by smell above the cell. It was then limed as usual. The juice was then turned on and after contact for ten minutes was drawn into the clarifier, where it was closely examined and sent to laboratory and analyzed.

It had a strong pungent odor of sulphur, as clear as water and perfectly colorless. It was apparent that too much gas had been added. Accordingly lime in large quantities was added, heated and settled. It was left slightly acid. The diffusion juice before treatment with this gas, the diffusion juice after treatment with this gas and after treatment with lime and the concentrated syrup, were all analyzed with the following results:

	Sucrose.	Glucose.	Glucose Ratio.
Diffusion juice without SO 2 gas	9.5	.62	6.52
Diffusion juice with SO 2 gas	7.5	2.47	32.93
Diffusion juice after liming and heating	4.8	4.85	101.40
Syrup	28.0	31.25	111.60

The above shows at least the danger of sulphur. Here at a temperature of not over 200° F. the inversion was large and

rapid. At boiling temperature it was fearful. No attempt was made to secure sugar from this syrup, since the glucose was far in excess of the sucrose. This gas was easily controlled in the clarifier as our previous experiments showed, and whenever sulphur is used in the sugar house, this form used as described in a former experiment seems to be preferable to any other, but it is certainly not adapted to use in the cell.

December 14th—On this day all operations in the sugar house were suspended leaving a few acres of cane standing in the field. This cane was divided into four parts.

No. 1—Left standing in the field.

No. 2—Put up carefully in matelas.

No. 3—Windrowed for the mill.

No. 4—Cut up and put away carefully as ensilage.

There were several questions proposed in these experiments. It was hoped that sufficient cold might intervene before working up these experiments, to give an opportunity of testing diffusion on frozen cane. It was designed further to test diffusion on cane, differently treated as above and lastly if cane can be preserved by *ensilaging* without detriment to its sugar, there are vast possibilities for future Central Factories.

PART FIRST—LEFT STANDING.

Unfortunately for the objects sought, but fortunately for the general interest of the planters of the State, the expected freeze did not occur. On the night of December 19th the foilage of the cane and most of the eyes were killed, but the cane was not frozen. The minimum temperature reached was 27° F. This standing cane was carefully watched after this cold spell and chemical analyses made weekly of its juice to detect deterioration if any should set in.

This cane was cut on the evening of January 13th and beyond a very slightly acid taste, no injury was perceptible. It was diffused on January 14.

January 14th—Diffused 6 tons of plant cane cut on the previous day. Calcic clarification in the cells. Constant current through the battery, discharging a cell every 15 minutes. Juice drawn from cell next to the last. This cane diffused with ease and suffered apparently no loss by standing.

Only first sugars have been made as yet from this run, the second masse cuite being still in the sugar house.

SUGAR HOUSE RESULTS.

Cane diffused, 6 tons. Chips to each cell, 401 pounds. Per centage of trash, 3.6 per cent.

LABORATORY ANALYSES.

	Sucrose.	Glucose.	Glucose Ratio.
Diffusion chips	.9	——	——
Mill juice	12.3	.72	5.85
Diffusion juice	8.6	.46	5.35
Syrup	44.9	2.39	5.32
First sugar	91.7	1.65	1.81
First molasses	48.9	7.41	15.15

The second masse cuite is yet in the hot room and no opportunity has been afforded since shutting down the sugar house in January of centrifugalling it.

It will remain through the summer and be worked just before the opening of next season.

PART SECOND—MATELAS CANE.

January 16th—Diffused 7 tons of plant cane taken from a mat, which had been laid down early in December. There was no sign of alteration of any kind, and so far as sight, chemical analysis and ease of diffusion, could detect, it was as sound and as perfect as on the day it was harvested. It was treated as the rest. Calcic clarification in the cell, but here for the first time the juice was drawn from the third cell from the last, leaving two dormant cells ahead. This process enabled us to send to the measuring tank a juice very near the boiling point—always running between 90° and 100° C. as shown by records of the Assistant at the measuring tank. By this process, the juice was thoroughly cleansed and required no farther clarification even for the manufacture of the finest sugar. This was demonstrated by actual trial of this juice in our vacuum pan by two prominent sugar makers of this State, who were here as visitors. They satisfactorily demonstrated the purity of the juice and its capacity to make the whitest sugar.

LABORATORY ANALYSES.

	Sucrose.	Glucose.	Glucose Ratio.
Mill juice	11.5	.85	7.48
Diffusion juice	7.9	.59	7.46
Syrup	37.2	2.57	6.90

The juice from this run was used in experiments at the vacuum pan by the sugar makers present, and by the Station in

further testing clarifying agents. No attempt was made to estimate the total sugars. The juice was excellent and made beautiful sugar.

The following experiments were made with

CLARIFYING AGENTS.

At the suggestion of Mr. Studniczka, of New Orleans, the Provident Chemical Works of St. Louis sent the Station, with their compliments, 5 gallons Liquid Acid Phosphate of 10° Baume for experimental purposes. It was received after we closed the sugar house in December and therefore had only one opportunity of giving it the test desired. This acid was carefully tested in the laboratory and found quite pure. In the regular working of the sugar house, this acid, if intelligently used would be a valuable addition. The juice coming from the mill should be limed to perfect neutrality and a very small quantity of this acid added until a faintly acid reaction was visible. Theory stamps this method as being the nearest approach to a perfect clarification and the limited practice of this station with pure phosphates would justify such a claim. *But there is always danger in its use*, since if added in too large a quantity, like all other acids, it will invert sugar rapidly. See Bulletin No. 10 for chemical action and experiments.

In the trial made this day the slightly acid juice directly from the cells was treated with excess of phosphoric acid and then limed nearly to neutrality. The clarification was very fair, but it settled slowly, too slowly for practical work. In concentrating to syrup the inversion was practically naught.

It is evidently undesirable, when clarification is performed in the cell, to use any reagent in the clarifier which will form a precipitate and necessitate a settling and decantation. The chief recommendation of cell clarification is the dispensing with the clarifier and its attendant delays, losses and expenses. Therefore, however useful this pure phosphoric acid may be in the clarification of mill juices, it is hardly desirable in diffusion work, when cell clarification is practiced.

FULLER'S EARTH,

which is successfully used for bleaching dark oil in our cotton oil refineries, was tried to-day upon cane juice. The clear juice from the cell was run through a layer of this earth, arranged so as to

act as a filter. It filtered quickly, but gave a dark lustre and a slightly acid taste to the juice, which was very objectionable. It was accordingly condemned and discontinued.

PART THIRD—WINDROWED FOR THE MILL.

January 18th—Diffused three tons of cane, windrowed in the usual manner for the mill on December 14th. It had kept well and no deterioration could be detected by any of the experiments to which it was subjected. The juice was treated as heretofore, drawing from the third cell from the last. Thus a juice of excellent quality was given which was turned over to the visiting sugar makers for the manufacture of white sugar. This they accomplished with ease and satisfaction to themselves. The chips from this run were used for

BURNING UNDER THE BOILER.

They were run twice through the three-roller mill and then sent directly to the furnace of a 30 horse fire box boiler, which is one of the two boilers used by the Station. This experiment was very successful, the mill taking them with great ease and delivering them in a continuous roll of about 1 to 1½ inches in thickness, not unlike in shape the roll of cotton delivered by a condenser to a large gin. These chips after passing twice through the mill burnt very readily under the boiler.

This experiment performed in the presence of several prominent planters and sugar makers, removed every doubt as to the feasibility of burning diffusion chips. The second rolling of the chips accomplished but little and it is believed that one rolling will suffice for good combustion in a regular bagasse burner.

These chips had, when sent to the mill	87.94	per cent. water.
After the first rolling	65.50	" "
After the second rolling	63.24	" "

PART FOURTH—ENSILAGED CANE.

Three tons of cane were cut up into small pieces of about one inch in length on December 16th and packed away into cylindrical iron tanks 7 feet high and 4 feet in diameter. The tanks were filled within 1 foot of the top and then carefully covered with paper. On the paper dry diffusion bagasse was packed to the depth of six or eight inches. Over this was spread a piece of canvas and on this again bagasse chips. Weights were placed upon the top and the tanks left in such a position as to be shielded from the Northern blast in case of a very cold

spell. High hopes were entertained of the success of this experiment. Could cane be successfully preserved in silos or cold storage rooms, the time of manufacture could be greatly prolonged and the chances for large central factories in the near future greatly enhanced. But our experiment failed. On opening the tanks, the cane was white and apparently to the eye, perfect. But the odor of vinegar soon regaled the olfactories, and a taste of one or two of the chips revealed its acid nature and the absence of sugar. Pending a chemical analysis of the chips to determine their value, a few cells were diffused, with *very unsatisfactory results.* Soon the entire sugar house was saturated with the acetous, odor and further working with them was deemed impracticable. The chips and juice were thrown away and the cells and sugar house limed from top to bottom.

The chips and the diffusion juice therefrom were investigated by the Laboratory with the following results:

The chips gave—

Moisture	83.72
Fibre	10.11
Solids dissolved	6.17
Total	100.00
Ether extract	.27
Alcohol extract	3.01

The mill juice gave:

Sucrose by polariscope	1.00
Sucrose by Fehlings	1.16
Glucose	.44
Total solids by Brix	6.00
Total solids by evaporation	6.34
Ash	.57
Solids Precipitated by Alcohol (95 per cent)	2.42
Solids Precipitated by Sub acetate Lead	1.81

10 grammes of juice required 13.6 N 10 of Ammonia solution for neutralization.

The diffusion juice from these canes gave—

Total solids, 2.9 per cent.; Sucrose, 0.5 per cent., and Glucose, .29 per cent.

The sugar in these canes, of which there was about 13 per cent at time of harvest, had evidently by fermentation been converted into alcohol and acetic acid, the most of which had evaporated.

This, our first attempt at ensilaging cane, was a serious disappointment, but may not some way be yet found by which canes can be preserved for an indefinite time? The importance of the subject demands further trials, which will be made in the future.

TRASH.

The hands who cut the cane were old cane cutters and per-

formed their work in the usual way. They did not pay very careful attention to a close separation of fodder from the cane, since they knew that the fan would remove the former. However, we do not believe that our trash was much above the average of Louisiana.

The average trash of the entire season was.......	3.6	per cent	of cane	cut.		
The average trash of the 2d year stubble was	3.98	"	"	"	"	"
The average trash of the 1st year stubble was.....	4.02	"	"	"	"	"
The average trash of the plant cane was..........	2.90	"	"	"	"	"

Unless great care is exercised in removing the leaves from the cane, both in cutting and loading, the trash will usually be from 2 to 4 per cent. of the cane cut.

WEIGHT OF THE CHIPS.

Several times during the season the cubical contents of our diffusion cells were carefully measured and found to be 13.52 cubic feet. Since one cubic foot of water weighs 62½ pounds, this will give us 845 pounds water to each cell. All through the season every effort was made to put as many chips in each cell as possible. To secure this a hand was kept constantly busy, packing them with a heavy timber, as they fell into the cell. Theory and practice both unite in recommending close packing for good extraction and concentrated juice. The following are the results of the season:

Second year stubble gave 350 pounds per cell or 25.9 pounds per cubic foot.

First year stubble gave 353 pounds per cell or 26.1 pounds per cubic foot.

Plant cane gave 395.5 pounds per cell or 29.25 pounds per cubic foot.

Average of above gave 366.3 pounds per cell or 27.10 pounds per cubit foot.

From the above the density of plant cane is considerably greater than stubble.

CONCLUSIONS.

The experience of the past season has been quite a varied one. Working by a new process, with new and untried machinery, it would have been miraculous to have encountered no difficulties and made no mistakes. It is therefore to the credit of the process, that so few delays were experienced and no break downs of any serious character occurred. Our heaters, *alone*,

gave us continued trouble, by leaking. Frequently when everything else was working very satisfactorily, a leak would be discovered, which while not interfering with the general work, would always tell in the summing up of results and in disturbing mental equilibrium. To stop these leaks required an entire cessation of work for several days and a testing by steam of every heater. This was done once and for several days thereafter no trouble was given. By using a back pressure of steam greater than the pressure of the juice in the cells, leakage of juice was prevented, but a dilution of the juice in the cell by the entry of the condensed steam occurred which was also quite objectionable from an experimental and economical standpoint. An entire overhauling of each heater is necessary before beginning the next campaign. Excepting these leaks, only one single accident occurred to our diffusion outfit which occasioned any repair, and this only required the work of a few minutes. One of the paddles of the fan came loose on one of our runs, and the work was continued through the experiment without the fan. Early the next day the fan was repaired and no further trouble experienced from it during the season. These candid statements of the slight difficulties of the running of new machinery, in an entirely new process, from early in September till late in January, serve to show the conspicuous merits of diffusion machinery, viz: the simplicity of its working and the entire freedom from expensive break-downs. In the experiments detailed above, many difficulties were encountered which would not be experienced with a large battery running continuously. Every day we began and finished an experiment using from three to twelve tons of cane. It takes at least one round of the battery before the cells become heated up to such a temperature as will ensure good extraction, and therefore the running of each diffusion experiment is always attendant with loss of sugar. In winding up a battery, a further loss occurs from failure to extract all of the sugar due to the diminishing number of washings which each cell receives. The last difficulty was partially overcome by using water freely in washing the contents of each cell before emptying as we neared the completion of each experiment. This, however, gave a largely increased dilution. From these causes, the average amount of sucrose left in the chips was much larger than it

would have been, had the battery been worked continuously. It was frequently the case, that the chips from the third and fourth round of the battery, after everything was well heated up, contained as low as .3 per cent of sucrose, while those from the first and last rounds would show several times this amount. It was due to this excess that the average sucrose in the chips was so high. In a well constructed battery, properly managed, the sucrose left in the chips should not exceed .5 per cent. It is very questionable whether it pays to get a larger extraction.

DILUTION.

From numerous experiments already given it is shown that the most economical results are obtained where an amount of juice equal to the weight of chips present is drawn from each cell. This on an average will be about 16 per cent. dilution on normal juice. Our cane usually contains about 90 per cent. juice. Of this amount only 83 per cent. is extracted by our best mills, leaving 17 per cent. in the bagasse. If we assume the average sucrose of our cane juices to be 12½ per cent. and that .5 per cent. be left by diffusion in the chips, this will give 96 per cent extraction, or 13 per cent addition to the mill extraction.

Therefore if we designate the volume of juice now extracted by the best mill at 100, the juice extracted by diffusion, provided it could be obtained undiluted, would be 117⅓. If diluted 16 per sent, it would be 117⅓× 16 per cent =136. Therefore in changing from the mill to diffusion, an increased capacity of evaporators and pans of at least one-third must be provided for while the increase in sugar can only be about one-sixth. In other words, there will be about 36 per cent increase in the juice, with an increment in sugar of only 17 per cent. Surely this compares well with some of our best mills, which now, with a saturation of at least 12--20 per cent., obtained as a return only 10 pounds of sugar per ton of cane.

WHAT SHALL WE DO WITH OUR CHIPS.

Three ways of successfully using them have been suggested :

1st. That they be returned to the soil as manure. When clarification is performed in the cell their fertilizing value is greatly enhanced. They can be evenly and nicely distributed over either plowed or stubble land, by one of the improved manure distributors.

This method of disposing of the chips is essentially the one suggested by rational agriculture.

2d. They can be burned under the boilers. After passing through the mill, diffusion chips can easily be burned and can thus be disposed of without further annoyance. Whether they can serve as a valuable fuel for making steam is a question not yet satisfactorily solved. Still there is every reason to believe that in a few years "this burning question" will be successfully settled.

This method of disposing of the chips is suggested by a present blind economy and should not be practiced save in a country where on account of scarcity the elements of fuel, Carbon and Hydrogen are rated by a tariff of prices similar to the elements of fertilizers in this State.

3d. They can be made into paper pulp. This Station has already forwarded to a New York paper mill, through Mr. J. H. Duggan, New Orleans, several tons of diffusion chips to be manufactured into paper, but it has not yet obtained the results. This question will also be soon settled.

This disposition of the chips is a manufacturing one. What will be the disposition of the chips, will soon be settled by actual experiments. That they will become ultimately a source of profit to the planter, is now clearly foreshadowed by the intense interest, which a money-loving and money getting people are taking in their disposition. Let no one be deterred from adopting the diffusion process of extracting sugar from the cane, because, as yet the disposition of the chips has not been satisfactorily solved. Humanity is at work on this problem and sooner or later it will be solved.

ESSENTIALS TO SUCCESS IN DIFFUSION.

1st. Finely comminuted cane. Hence necessity of keeping knives sharp.

2d. Abundance of heat, so as to maintain the temperature between 200° to 212° F.

3d. Time of diffusion of each cell. It has been found here that 10 minutes to each cell is probably the minimum time for good extraction.

The above are absolutely essential for the best work.

It might be added that packing the chips tightly in the cell is also productive of good, while the depth of the cell and the slowly continuous current through the cell seem to have certain influences also upon extraction. Removal of the leaves and adherent sheaths gives a purer juice—hence no battery should be without a fan for cleaning the chips.

For economic diffusion there must be a limit to dilution. From experiments already described, this limit is included between 15 and 20 per cent on the normal juice in the cane.

ERRATA

On page 326, fifteenth line from top, for inverted, read inserted.

On page 337, second line below table of analyses, for 90.40 lbs., read 9040 lbs.

On same page, sixth line, for 9.7 lbs., read 97 lbs.

On page 339, seventh line below table of analyses, for one masse cuite, read our masse cuite.

On same page, eighth line, for per to, read per ton.

On same page, seventh line from bottom, for nearly eight, read ninety-eight.

On page 340, first line below table of analyses, for 93.35 per cent, read 90.35 per cent.

On page 360, eighth line from bottom, for obtained, read obtain.

No. 24.

BULLETIN

OF THE

AGRICULTURAL EXPERIMENT STATION

OF THE

UNIVERSITY OF LOUISIANA

AND

AGRICULTURAL AND MECHANICAL COLLEGE.

BATON ROUGE, LA.

WM. C. STUBBS, Ph D., Director. B. B. ROSS, M. S., Chemist.

Rice and its By Products.

ISSUED BY THE BUREAU OF AGRICULTURE,
T. J. BIRD, Commissioner.
BATON ROUGE, LA.

THE AGRICULTURAL EXPERIMENT STATION

OF THE UNIVERSITY OF LOUISIANA.

BUREAU OF AGRICULTURE.

GOV. F. T. NICHOLLS, President.

WM. GARIG, Vice-President Board of Supervisors.

T. J. BIRD, Commissioner of Agriculture.

STATION STAFF.

WM. C. STUBBS, Ph. D., Director,

D. N. BARROW, B. S., Assistant Director, Baton Rouge.

J. G. LEE, B. S., Assistant Director, Calhoun.

Assistant Director, Audubon Park.

B. B. ROSS, M. S., Chemist.

M. BIRD. B. S., Assistant Chemist.

A. T. PRESCOTT, M. A., Botanist.

H. A. MORGAN, M. S. Entomologist and Horticulturist.

W. H. DALRYMPLE, M. R. C.V. S., Veterinary Surgeon.

A. M. GARDNER, B. S,, Farm Manager Audubon Park.

J. E. PRATT, Farm Manager, Baton Rouge.

L. M. CALHOUN, Farm Manager, Calhoun.

H. SKOLFIELD, Treasurer.

J. D. STUBBS, Secretary.

The bulletins and reports will be sent free of charge to all farmers, by applying to Major T. J. Bird, Commissioner of Agriculture, Baton Rouge, La.

LOUISIANA STATE UNIVERSITY AND A. AND M. COLLEGE,
Office of Experiment Stations.
Baton Rouge, La.

Major T. J. Bird, Commissioner of Agriculture, Baton Rouge, La.:

Dear Sir: I hand you herewith a report upon Rice and its by-products. I ask that it be published as Bulletin No. 24.

Embodied in this report is the thorough chemical investigation of rice and all of its by products by Prof. B. B. Ross. It is believed that this will be a valuable contribution to the scientific literature of this cereal.

Respectfully submitted,
WM. C. STUBBS, Director.

Mr. Hugh N. Starnes opens an article upon the "Rice Fields of Carolina," in the *Bivouac*, with the following:

"Colonel John Screven, a distinguished rice planter of Savannah, some four years since, in a public address, referred to a rice plantation as a "great agricultural factory." Mr. Trenholm, of Charleston, lately a prominent member of the United States Civil Service Commission, a year or two afterward made use of nearly the same words, though evidently in ignorance of their previous employment. That authorities so high and entirely independent should mutually employ the same expression is most excellent *prima facie* evidence of its applicability and epigrammatic fitness.

And a factory truly a rice plantation is, in the fullest sense of the the word; for Nature—passionless step-mother that she is—exerts so slight and attentive art so complete and watchful a control over every process attending its production, that rice is substantially "manufactured," not cultivated.

But in this instance utilitarian art blends unconsciously a wondrous beauty with its practical economies. No fairer prospect exists in the whole realm of agriculture than the landscape of a well-appointed rice plantation, whether viewed in early spring before planting, with the tawny seams of its embankments

intersecting the checkered squares, the mellow mold yet steaming from the plow, and the whole visible area apparently as cleanly swept and garnished as a parlor floor; or later, during the nursery reign of the fostering "stretch water," each square a lake, its wavelets rippling under the fresh sea breeze, with the top of the young plants immersed, for forcing in long, waving lines of tendrils floating on the water, and the russet banks, separating lake from lake, now paths of emerald, their grassy carpet blowing in the April sun; or later still, during the "long water," the entire landscape one waving sea of green, broken only by the crystal ribbons of canals and quarter drains; or, finally, in the full noontide of harvest-time, the level fields, now lakes no more, but vast stretches of stubble dotted with stacks of golden grain, as if an army tented there.

The wheat lands of Dakota are impressive, but their unbroken unrelieved monotony is almost painful. The vine-clad hills of the Upper Ohio are novel and interesting; the velvety slopes of the valley of the Roanoke and Kentucky's blue-grass meatdows pretty and attractive; but a study of the rice-fields of he Atlantic deltas is simply fascinating. e

In other agricultural pursuits man's efforts are th sport of the elements, and largely dependent upon the caprice of nature. In this man works with God, in the very shadow of his presence, with intelligence and judgment regulating the wayward freaks of nature, grafting chemical affinity and physical force. and directing both to an end, reasonably certain if properly compassed."

The botanical relation of rice and the various species now under cultivation have been discussed in Bulletin 15 of this Station.

In this same bulletin the results of experiments with rice, using the different fertilizers, with a view of determining the manurial requirements of this cereal, are presented. These experiments have been continued under varying conditions, and as yet with no positive conclusions. In 1888 a series of experiments was conducted upon the adjoining plantation of Messrs. Soniat Bros. Through their kindness every facility was afforded and enjoyed of properly conducting this work. On April 25th the ground was broken and harrowed, fertilizer distributed broadcast, rice sown and both harrowed in together. This was nicely accomplished by harrowing both ways.

The following are the experiments with manures used per acre.

Experiment No. 1—No manure.
" " 2—75 lbs Sulphate of Ammonia.
" " 3—{ 300 lbs. Cotton Seed Meal. 150 lbs Acid Phosphate. }
" " 4—{ 75 lbs. Dried Blood. 37 lbs. Bone Meal. }
" " 5—No Manure.
" " 6—200 lbs. Cotton Seed Meal.
" " 7—{ 200 lbs. Cotton Seed Meal. 100 lbs Acid Phosphate. }
" " 8—{ 100 lbs. Cotton Seed Meal. 25 lbs. Fish Scrap. 25 lbs. Nitrate Soda. 100 lbs. Acid Phosphate. }
" " 9—No Manure.

The straw was not weighed. Each experiment was taken to thresher and carefully threshed separately, with following results in grain.

Experiment No. 1—1382 lbs.
Experiment No. 2—1392 lbs.
Experiment No. 3—1664 lbs.
Experiment No. 4—1543 lbs.
Experiment No. 5—1056 lbs.
Experiment No. 6—1544 lbs.
Experiment No. 7—1884 lbs.
Experiment No. 8—1677 lbs.
Experiment No. 9—1559 lbs.

The above experiments were made upon cuts varying in size from one and one half to two acres. The natural fertility of the soil varied greatly, as the results of the plats with "no manure" plainly show. The average of the three "no manure" plats was 1332 lbs. It is difficult therefore to deduce conclusions as to the actual benefits of the fertilizers used, and to attempt it would be misleading. But one fact is quite apparent and that is a mixture of two parts of cotton seed meal and one part of acid phosphate has given the largest yields. Comparing Nos. 3 and 7 with "no manure" there is found to be quite a balance in favor of this mixture. In Experiment No. 8, where cotton seed meal is partially displaced with fish scrap and nitrate soda, the yield is still large

but not so great as No. 7. These results were obtained by the usual water culture. Simultaneously with these the following series of dry culture was inaugurated on the grounds of this station. A plat of ground which had the previous year been in early corn and sweet potatoes was selected and carefully broken broadcast with four horse plow, the ground levelled and pulverized with harrows. Rows were laid off 18 inches apart with a small shovel plow. The plat divided into 20 parts. The rice was sown in the drill and the manures applied broadcast and both harrowed in at the same time. This was done on March 29th. The following were the manures used per acre.

No. 1—200 lbs. Acid Phosphate.
50 lbs. Muriate Potash.

" 2—200 lbs. Acid Phosphate.
50 lbs. Muriate Potash.

" 3—No Manure.

" 4—300 lbs. Tankage.

" 5—200 lbs. Cotton Seed Meal.
200 lbs. Acid Phosphate.
50 lbs. Nitrate Potash.

" 6—225 lbs. Cotton Seed Meal.
200 lbs. Acid Phosphate.
50 lbs. Sulphate Potash.

" 7—225 lbs. Cotton Seed Meal.
200 lbs. Acid Phosphate.
50 lbs. Sulphate Potash.

" 8—225 lbs. Cotton Seed Meal.
200 lbs. Acid Phosphate.
200 lbs. Kainite.

" 9—No Manure.

" 10—225 lbs. Tankage.
200 lbs. Acid Phosphate.
200 lbs. Kainite.

" 11—250 lbs. Fish Scrap.
200 lbs. Acid Phosphate.
200 lbs. Kainite.

" 12—200 lbs. Dried Blood.
200 lbs. Acid Phosphate.
200 lbs. Kainite.

" 13—75 lbs. Sulphate Ammonia.
200 lbs. Acid Phosphate.
200 lbs. Kainite.

" 14— { 112½ lbs. Nitrate Soda. 200 lbs. Acid Phosphate. 200 lbs. Kainite. }
" 15—No Manure.
" 16— { 225 lbs. Cotton Seed Meal. 200 lbs. Acid Phosphate. 200 lbs. Kainite. }
" 17— { 200 lbs. Acid Phosphate. 200 lbs. Kainite. }
" 18— { 225 lbs. Cotton Seed Meal. 200 lbs. Kainite. }
" 19— { 225 lbs. Cotton Seed Meal. 200 lbs. Acid Phosphate. }
" 20—225 lbs. Cotton Seed Meal.

Upon experiments Nos. 1 and 2, on May 10, when rice was well up, were scattered broadcast 112½ pounds nitrate soda and 75 pounds sulphate of ammonia.

This plat was kept clean of grass and weeds by frequent hoeing and received no water except from rains. The rice grew finely and early in August presented a beautiful appearance, showing clearly the distinction between the manured and unmanured plats. Every hope was entertained of a successful issue of the experiments until the night of August 19th when the Station was visited by a fearful storm which prostrated nearly everything. The fences were blown down and during the night a large quantity of cattle roamed over the plat nipping the heads of rice just now beginning to ripen. In this way the comparison of results was rendered impossible. The rice was cut and threshed, but the results were so discordant that they were discarded as useless.

An inspection of above will show that an attempt was made to test thoroughly every manurial want of rice on this soil and it is greatly to be regretted that a series of experiments so promising and so near maturity should have been so suddenly vitiated.

CONCLUSION.

Although our experiments have not positively declared the fertilizing ingredients needed by rice on our alluvial soils, yet the suggestion of a mixture of nitrogen and phosphoric acid as

a suitable fertilizer for this cereal is very strongly made. In no form can they be better presented to this crop, than in cotton seed meal and acid phosphate, using them in the proportions of two parts of former to one of the latter. This mixture should be applied broadcast on the land after it is thoroughly broken and harrowed and then harrowed in with the rice. It is quite certain that thus carefully applied, quantities from 300 to 500 lbs. per acre will prove remunerative.

THE CHEMISTRY OF RICE AND ITS PRODUCTS.

Rice is a staple article of human food and its value is well understood. Its by-products, "rice bran," "rice polish," "rice straw," "rice hulls" and "rice hull ashes," have not yet been introduced into distant markets, though used to some extent at home. Frequent inquiries are made as to the values of rice bran and rice polish as cattle food and their comparative merits with wheat bran and cotton seed meal and gluten. The following correspondence has recently taken place, which will explain itself.

THE LOUISIANA SUGAR AND RICE EXCHANGE,
New Orleans, Sept. 16, 1889.

DR. W. C. STUBBS, Kenner, La:

Dear Sir—I hand you herewith for analysis sample of gluten meal sent me from Chicago and quoted there at $16 00 per ton, f. o. b. Rice bran is selling here at $6 00 to $7 00 per ton. With the analysis please send formula for calculating the commercial values of such stuffs, as without a formula, the analysis has but little meaning to a layman.

Yours respectfully,
D. D. COLCOCK, Secretary.

LOUISIANA SUGAR EXPERIMENT STATION,
Kenner, La., Sept. 24, 1889.

MR. D. D. COLCOCK, Sugar Exchange, New Orleans,

My Dear Sir—Yours received. For the purpose of comparing the valuation of different kinds of feed stuffs, a tariff of prices of different ingredients has been determined from the analyses of leading articles with fixed values per ton. The Connecticut Ex-

periment Station has thus determined the cost of ingredients as follows:

Albuminoids, 1.6 cents per pound.
Fat, -------- 4.2 " " "
Carbohydrates, .96 " " "

The following are analyses:

	Water	Ash	Fat	Fibre	Albuminoids	Carbohydrates
*Rice Bran..........	10.67	11.10	9.97	10.95	11.29	46.02
*Rice Polish.........	10.63	5.45	7.02	2.62	10.94	63.34
Gluten..............	8.45	1.15	8.79	.77	30.81	50.13
‡Rice Bran..........	9.56	8.82	9 50	11.81	9.85	50.46

If we apply the above tariff of prices we will find for Rice Bran the following in a ton

225.8 lbs. Albuminoids at 16 cents------------------$3 61
199.4 " Fat at 4.2 cents---------------------------- 8.36
9.20 " Carbohydrates at 96 cents------------------- 8.83

Value per ton---------------------------------$20 80

In like manner we find:

1 ton Rice Polish worth-------------------------------$21 55
1 " Glutin Meal worth------------------------------ 26 85
†1 " Rice Bran--------------------------------------- 20 81

By same tariff we have value:

1 ton Cotton Seed Meal--------------------------------$30 37
1 " Linseed Meal------------------------------------ 25 92
1 " Wheat Bran-------------------------------------- 20 22
1 " Wheat Middlings--------------------------------- 21 20
1 " Corn Meal--------------------------------------- 19 59

These are relative commercial values and by no means represents the true feeding value. The latter is determined by the wants of the animal fed and the food which the above are required to supplement. The above are denominated concentrated fodders and are used only to supplement coarser foods. Therefore to compare Gluten with Rice Bran, from an economical feeding standpoint, two things must be determined by the purchaser: First, the demands made on animal feed, which determines the character of rations to be used, and secondly, the composition and digestibility of the coarser foods, to which the above are only supplemental. An animal may be fed for work, flesh, milk, wool or simply for maintenance. These require different proportions of the valuable ingredients of food and to meet each, accurate formulas have been prescribed from actual experiments upon animals kept for various purposes mentioned above. To

* Made by Prof. Ross from samples sent by you.
‡Made by Hutchinson from samples sent by Mr. Bloomfield.
†Mr. Gay's sample.

illustrate: It has been found that a cow weighing 1000 pounds, to give the best flow of milk, must be fed upon a daily ration containing 24 pounds dry matter, consisting of 2.4 pounds albuminods, .4 pounds fat and 12 pounds carbohydrates, or with a nutritive ratio of one part of albuminoids to four to five of carbohydrates. In maintenance the ratio is considerably increased. The above ingredients all must be digestible, which is carefully determined both in the laboratory and stables.

It can now be seen that while the above feeds can be compared commercially, they cannot be from an economical feeding standpoint. Gluten can be better used as a supplement to coarse hays and straws—while Rice Bran or Polish would serve better as adjuncts to the best hays and fodders. At some day, I trust not far distant, the entire subject of economic feeding, may be as thoroughly understood in Louisiana, as it is to-day in several of the Northern and Western States.

Yours respectfully,
W. C. STUBBS.

The analysis given further on, shows that rice straw even when properly cured, contains an excess of mineral and indigestible matter and therefore has a low feeding value. It should be supplemented largely with concentrated foods when used for fodder.

Ashes of rice hulls are almost totally devoid of fertilizing ingredients and therefore are nearly worthless. To give an idea of how these products of rice are obtained, the following is inserted:

"The rice is threshed in the straw by a thresher similar to the one used to thresh other small grains. It is now 'rough rice' and as such is shipped to the city of New Orleans where it is usually sold to the millers, on the floor of the Sugar & Rice Exchange.

The process of milling can be understood by the following extract from the article quoted from above. The first process is "screening" to remove foreign particles, trash and foot-stalks. The paddy then passes to the "milling stones," where the outer husk is removed. The rice falls through an opening in the upper stone, and the revolution of this stone, or "runner," as it is called, over the "bed-stone" which, as its name indicates, is fixed, produces, or is supposed to produce, a draught, which causes the grains to fall into a semi-upright position at an angle

of about forty-five degrees. The runner, revolving over the bed-stone at a distance above it equal to about two-thirds the length of the rice grain, then cracks or splits open the husk, the grain dropping out and husk and grain both passing out together. The moving grains have a uniform centrifugal motion from the center of the stones to their circumference. They can be raised or lowered, and regulated with adjustment for large or small grain.

From the stones the material passes into a horizontal screen, called the "screen blower,," where the ground-up chaff and small particles of grown grain, reduced by the action of the stones, are separated and blown out. This is used to mix with the rice flour. Some grains of rough rice have gone through the stones without being husked ; these now pass over the head of the horizontal screen and are conveyed back to the stones. The main portion of the chaff blown out the screen is carried to the "shaker," where the small particles of broken rice still remaining are seperated, in order that nothing may be wasted, and then passed from the shaker to the "chaff fan," where they join the residue from the screen blower consisting of all heavy particles other than the unhusked head-rice and a little remaining chaff, which is left to give the rice elasticity under the pestles.

Passing from the chaff fan which separates still more of the chaff, the rice goes into the "ground rice bin." This is a long gallery over the pestles, so arranged that the rice is distributed regularly over the holes or sluices leading to the mortars beneath, into which it is delivered in a constant stream that may be increased, diminished, or stopped at pleasure.

The rice is now of a white or mixed white and yellow color. The outer covering or husk has been cracked off and nearly all the loose chaff removed, and the next process is the "skinning" or decorticating process, which is accomplished by the pestles. It is necessary to remove the yellow, gluey covering of the grain to give it the creamy color so much desired. This the pestles do by friction. The mortars hold from four to six bushels each, and are made of wood cased with iron ; the pestles are also of wood cased with iron at the lower end, are about ten feet long and four hundred pounds each. The mortars are ranged in a long row boarded in so as to resemble somewhat the counter in a shop, only lower. The pestles are raised and dropped into the mortars by means of a huge horizontal revolving drum as long as the mortar counter and fitted with spokes, which, as the drum counter and fitted with spokes, which, as the drum revolves, pass into and under slots in the pestles, raising them up, passing out and dropping them suddenly with a heavy thud into the mass

of rice in the mortars. Each one can be stopped and pinned in place without interfering with the others.

Strange to say, the heavy weight of the pestles breaks very little grain.

When sufficiently decorticated the contents of the mortars, consisting now of flour, fine chaff and cleaned rice of a dull, filmy, creamy color, are removed to the "flour screen" where the flour is sifted out. From thence the rice and fine chaff go to the "fine-chaff fan," where the fine chaff is blown out and mixed with the other flour. The rice flour, as we call it, or more properly "rice meal," as our English neighbors term it, is very valuable as stock feed, being rich in hydro-carbons as well as albuminoids.

From the fine-chaff fan the rice goes to the "cooling-bins," which the heavy frictional process through which it has just passed render necessary. It is allowed to remain here for eight or nine hours, and then passes to the "brush screen" whence the smallest rice and what little flour is left pass down one side, and the larger rice down the other.

The grain is now clean and ready for the last process—polishing. This is necessary to give the rice its high pearly luster, and makes all the difference imaginable in its appearance. The polishing is effected by the friction against the rice of pieces of moose hide tanned and worked to a wonderful degree of softness, loosely tacked around a double cylinder of wood and wire gauze. From the polishers the rice goes to the seperating screens, composed of different sizes of guaze where it is divided into its appropriate grades, then barrelled, headed and made ready for market."

This description will serve to explain how the different products, whose analysis are given further on are obtained.

The accompanying paper has been prepared by Prof. B. B. Ross, the Chemist of State Experiment Station at Baton Rouge, and it is believed that this is the first complete chemical examination that has ever been made of rice and its products. The attention of the public is earnestly called to this able paper. It is of peculiar importance to the rice planter and millers and to those concerned in economic cattle feeding, the analysis of rice bran and polish and their comparison with other standard feeds, must be of special interest.

INVESTIGATION OF THE COMPOSITITION OF RICE AND THE VARIOUS PRODUCTS OF THE RICE MILLING PROCESS.

BY PROF. B. B. ROSS, CHEMIST.

The chemical literature of rice and the products of rice mills has, up to the present time, been very meagre in quantity and very incomprehensive in scope. With the exception of analyses of rice and rice polish by the Connecticut Agricultural Experiment Station; of bran, polish, hulls, etc., by the North Carolina Experiment Station in 1882, and an investigation of the composition of rice bran and polish by the Louisiana Sugar Experiment Station in 1887, very little has been published with regard to the chemical composition and properties of rice and its products. It was therefore determined by the Station to make an accurate chemical investigation as to the composition, digestibility and nutritive values of the field and mill products of this valuable bread grain. Accordingly through the courtesy of Mr. D. D. Colcock, Secretary of the Louisiana Sugar and Rice Exchange. there were procured from one of the principal rice milling establishments of New Orleans, samples representing the products of the different steps in the preparation of rice for the market. To these were added a sample of the ashes obtained by burning the rice hulls under the boilers of the mill, and a sample of rice straw obtained from Soniat Bros., Tchoupitoulas Plantation, Jefferson Parish. For the sake of convenience in analysis, and tabulation of results, the samples selected were designated by the following numbers.

Sample No. 1—Rough Rice—was apparently drawn from a lot of the rough grain, just as shipped from the plantation, as it had not been freed from the attendant particles of straw, trash, etc.

Sample No. 2—"Rice from the stones,"—represented the rough rice after being passed between the stones which are used to seperate the hulls from the grain. Both the appearance and chemical analysis of the samples however, indicated that a large proportion of the hulls had been removed and there is accordingly a considerable discrepancy between its composition and that of rough rice.

No. 3—Pounded Rice—is obtained by pounding the grain, from which most of the hulls have been separated, for some time in mortars to remove the second coating of the rice grain in the form of bran, which constituted sample No. 4.

Sample No. 5—Or rice from the "cooling floor"—exhibits the grain from which the bran has been detached by the pounding process just referred to.

No. 6 represents the polish which is obtained by brushing off the coating of the grain from the "cooling floor" sample.

No. 7—The milled rice is the thoroughly cleaned grain ready for the market.

No. 8 is a sample of the hulls removed from the rough rice by means of the fanning process, and No. 9 is an air dried sampel of rice straw. No. 10 is the sample of ashes before referred to. Preparatory to analysis, the samples, with the exception of the rice bran and polish, were subjected to a thorough grinding and pulverization in order to secure as fine a mechanical division of the particles as possible. In addition to the proximate constituents ordinarily determined in feed stuffs, viz: water, fat, fibre, crude protein and carbohydrates, true albuminoids and digestible albuminoids have also been carefully estimated, the latter by means of an artificial gastric juice. The methods of analysis followed, were with slight modifications, those adopted by the Association of Official Agricultural Chemists of the United States. In the determination of fats it was found necessary to continue the percolation with ether for at least twelve hours in order to insure the complete extraction of fats from a majority of the samples analyzed. Instead of using individual condensers for each percolator, it was found advantageous to attach the latter to the

lower ends of tubes passing vertically through a tin condenser, 20 inches in height, the large bulk of water contained therein undergoing a scarcely appreciable rise in temperature. The tared flasks were all heated by contact with water contained in an elongated water bath, thus rendering the regulation of the rate of evaporation comparatively easy.

In the estimation of fibre, an improvised apparatus was used, by means of which a great saving of time and labor in fibre determinations was accomplished and very closely corresponding results were obtained. Four Erlenmeyer flasks of 500 cubic centimeters capacity each were used in the determinations, and were placed in a row upon a stand like that used for the support of the distillation flasks in Kjeldahl's nitrogen method. The flasks were wide mouthed and were fitted with No. 7 Eimer and Amend rubber stoppers with double perforations. Through one of the holes in each stopper was passed the short arm of a glass tube bent at right angles, the longer arm being connected by a short piece of rubber tubing with a glass tube dipping in a large beaker sitting on the stand in rear of the central flasks. Through the other perforation of the stopper is passed the short arm of a syphon-shaped tube, the lower end of which is connected, by means of a short piece of rubber tubing, with an inverted funnel, (1 inch in diameter,) covered with fine muslin. The outer and longer arm of the syphon tube has a rubber connection with a glass tube passing through a stopper into one of the three necks of a Woulff's bottle. This rubber connecting tube can be opened or closed at pleasure by means of a burette pinch cock. The two outer necks of the Woulff bottle are supplied with double perforated stoppers with tubes for connection with the Erlenmeyer flasks, while the central neck is supplied with a tube leading to a filter pump, and a syphon overflow tube with burette clamp attached. The Erlenmeyer flasks are each marked at a point indicating 200 C. C. capacity, and the short funnel arm of the syphon tube is so arranged that it will readily slide up and down through the opening in the stopper. The sulphuric acid of 1¼ per cent. strength is placed in

the large beaker on the rear of the stand, the tubes from the flasks dipping in the liquid. The sample to be analysed having been placed in the several flasks, and the funnels having been drawn up above the 200 C. C. line, the filter pump is started and the flasks fill readily, the flow of acid into the flasks being regulated easily by means of the pinch cocks attached to the syphon tubes. While the acid solution is boiling, the loss of the water by evaporation, can be replaced by running in water by suction from the large beaker or beakers formerly containing the acid, though the tubes must not dip in the beakers, except when it is desired to replace the evaporated water. When the usual half hour limit of boiling has been reached the funnels are lowered nearly to the bottom of the flasks and the liquid is quickly filtered off by means of the filter pump. Having raised the funnels above the 200 C. C. line, but without opening the flasks, they are filled by suction, up to the mark referred to, with water, and the contents are boiled for twenty to thirty minutes and after filtering as before, the process is repeated. In the same manner the sample is treated with the alkali solution and afterwards twice with water, the liquid being syphoned off and the flasks filled up as before described. The undissolved residue in each flask is now brought upon a filter, prepared by placing a plug of freshly ignited asbestos at the apex of the cone of an ordinary glass funnel. It is then washed with hot water, alcohol and ether as usual, and dried in an air bath at from 100 to 110 degrees C. The funnel is next inverted in a platinum dish and weighed, after which the contents of the funnel are transferred with the aid of a spatula and feather to the dish, preparatory to thorough ignition. The funnel is then replaced in the dish, and dish and contents are again weighed. The loss in weight represents fibre. This method of filtering and weighing is especially advantageous when the residues are bulky and Gooch crucibles of sufficient capacity or number are not at hand.

In the utilization of this process of fibre determination, the amount of time consumed in the operation was lengthened, but the

care, attention and labor of manipulation was much reduced. The number of flasks can be increased, if so desired, and a large number of determinations can be made simultaneously. In the estimation of crude and true albuminoids, as well as of digestible albuminoids, the Kjeldahl battery was used and gave uniformly satisfactory results. Appended are found the results of analyses of all the various samples above described, the composition of both the air dried and water free substance being given. In addition the per centage digestibility of albuminoids, and the per cent ratio of true albuminoids to crude albuminoids is stated.

There are also added, mainly for the sake of comparison, analyses of wheat and rye bran, wheat shorts, the straw of wheat, rye and oats and the chaff of wheat and oats. These data were obtained chiefly from reports of the Connecticut Agricultural Experiment Station.

EXPLANATION OF ANALYSES.

In the analysis of feed stuffs the proximate and not the ultimate (or elementary) constituents are generally determined. It has been found that in order to arrive at the relative merits of fodders, etc., for feeding purposes, it is only necessary in most cases to ascertain the percentages of ash, albuminoids (or protein), fats, carbohydrates, and woody fibre, or cellulose. It is also of the utmost importance that the proportion of water present in the sample be correctly determined, as the percentage of this substance in feed stuffs is so variable that no proper comparison of their relative nutritive values can be instituted until the proportion of the constituents present in the dry substance can be ascertained.

The amount of dry matter can be determined by heating the substance at a temperature of 212 degrees, Fahrenheit, until the sample shows no further loss of weight; the difference in weight representing the amount of water present. Upon exposure to the atmosphere the dry sample will re-absorb a considerable proportion of moisture, usually regaining the amount previously contained in the air dried feed stuff.

The ash contains the mineral constituents of the feeding stuffs, and its proportion is ascertained by burning out the combustible,

portions, with free access of air. These mineral substances consist chiefly of potash, soda, lime and magnesia in combination with hydrochloric, carbonic, phosphoric and sulphuric acids, and also silica, together with a little unconsumed charcoal.

As these mineral substances generally occur in sufficiently abundant quantities in most forage plants, the amount of ash is considered of little importance in estimating the feeding value of feed stuffs. Crude protein (or albuminoids) constitutes the chief bulk of nitrogenous substances present in feeding stuffs. The term is quite comprehensive in its scope, and includes such substances as casein of milk, fibrin of flesh, and albumen of blood and the egg, which are considered as modifications of a primary substance (protein), these different forms bearing a general resemblance to each other in composition and properties, and convertible into each other by processes carried on in the animal body. These albuminoid substances contain carbon, hydrogen, nitrogen, and oxygen, and frequently a proportion of sulphur. Indeed, the exact chemical composition of the different modifications of albuminoids has not been definitely determined, but it is known that nitrogen is one of the least variable (in quantity) of their constituents, and that the average proportion of that valuable element is about sixteen per cent. So that, in analysis of feed stuffs, the rule generally adopted in ascertaining the percentage of albuminoids is to first determine the percentage of nitrogen present and then multiply this percentage by 6.25 (16x6.25—100). This does not give us the exact but only the approximate amount af albuminoids present, as all albuminoids do not contain sixteen per cent., nor is all the nitrogen in the feed stuffs combined in the form of albuminoids. However, in the statement of the percentages of the proximate constituents determined, the proportion of crude albuminoids given is in each case obtained by multiplying the nitrogen present by 6.25. This has been done because it approximates very closely the true percentage, and because all of the standards of comparisons to which we can refer in determining the relative nutritive values of feed stuffs, give albuminoids as determined in the same manner.

In the analysis of all of the samples, however, both albuminoidal and non-albuminoidal nitrogen have been determined, but the analysis of sample 2 and also of samples 8 and 9 (hulls and straw) indicates the absence of non-albuminoid nitrogenous substances. The different non-albuminoidal nitrogenous bodies occurring in the various parts of plants are nitrates, nitrites, ammonial salts, alkaloids, amide bodies, etc. The last named class is the most abundant in occurence, though the nutritive value of amide substances has not been clearly defined as yet. As a general rule these substances decrease in quantity as the plant approaches maturity, being utilized to some extent in the further production and elaboration of albuminoids. They are almost invariably more soluble than protein compounds, and in chemical analyses, they are dissolved out very readily after the albuminoids not already insoluble have been precipitated or coagulated. In the table of analyses given it is seen that he largest percentages of non-albuminoidal nitrogen are found in the rough rice, bran and clean rice.

The albuminoids are regarded as the chief constituent of value. as, without undergoing any very considerable alteration, they are utilized in the animal body, in the formation of animal albuminoids, such as the fibrin of muscles and tendons, and the albumen and casein of blood and milk ; and not only contribute to the growth of the animal, but tend to repair and replace the worn out muscles, membranes, tissues, etc.

The term fats includes all matters extracted from the dry fodder by ether, and the proportion of fats is generally less than that of any other proximate constituent. Vegetable fats are utilized in the animal economy, either in making fat or in furnishing heat to the body by the oxidation of their carbon and hydrogen, this process of oxidation being perfectly analagous to the ordinary processes of combustion.

The class of substances called carbohydrates are, in conjunction with the fats. also of great utility in producing and maintaining animal heat, but practical experiments, within recent years, have led scientists to believe that fats have two and one-

half ($2\frac{1}{2}$) times the value of carbohydrates in the production of heat by their oxidation. Carbohydrates, as the name implies, consist of carbon together with hydrogen and oxygen, in the relative proportions in which they exist in water. Under this term are included starch, sugar, gums and other bodies closely allied in chemical composition and properties.

Of course the predominating constituent of this class occurring in rice and its products is starch. This substance in the granular form, under ordinary conditions, is completely insoluble in cold water, and even in a very finely powdered state, only a small proportion is dissolved. When heated nearly to boiling with water the particles of starch swell up forming a gelatinous mass, miscible with water, but very little comes in solution. When heated to a much higher temperature out of contact with water it forms dextrin or British gum, readily recognized by its mucilaginous characteristics. It is only when pure starch granules, or grains rich in starch and in finely powdered condition, are boiled down with water that a viscid liquid of uniform consistency is obtained. When the grains, in an integral state or very coarsely powdered, are thus treated, the individual grains expand separately forming in the aggregate a very palatable and digestible mass. Starchy grains, when thus treated, or when their starch is converted into dextrine at a higher temperature, furnish a large proportion of nutritious and heat producing constituents to the animal body. Both starch and dextrine are readily acted upon both by the saliva and the pancreatic juice, being converted into sugars, in which form they are readily assimilable. The cellulose or fibre, constitutes the most insoluble and generally the most indigestible portion of feeding stuffs. Although pure cellulose (as lint cotton) is identical in composition with starch, in its physical properties and chemical deportment there is the widest difference. It was formerly considered almost if not wholly indigestible, but experiments have shown that quite a large percentage is digested by animals, and may be turned to account either as an auxiliary or as a substitute for fats or carbohydrates, in furnishing oxidizable and heat producing constituents to the blood.

In order that each of the constituents of feeding stuffs may be utilized to the greatest possible advantage, in the performance of their several functions in the animal economy, it has been found essential that they exist in certain relative proportions, just as in the application of commercial fertilizers to soils the relative percentages of their three essential constituents must be taken into consideration.

It has been ascertained by carefully conducted experiments in cattle feeding that in estimating the comparative feeding values of fodders, there should be determined what is known as the nutritive ratio—or, the ratio of digestible carbohydrates to digestible albuminoids—just as in the operation of a steam engine there s a ratio between the cost of fuel and the cost of the materials of of repair. In determining this nutritive ratio, fats must also be taken into consideration, and as they are assumed to have a value of two and one half (2½) times their weight of carbohydrates, the amount of digestible fat, after being multiplied by two and one-half (2½) is added to the digestible carbohydrates.

In calculating the nutritive ratios of the bran, polish and straw analyzed, the percentages of digestibility of the carbohydrates and fats were taken from the results of practical digestion experiments on wheat bran, shorts and straw, while the percentage digestibility of albuminoids was determined by means of artificial digestion with pepsin solution.

It was found that the bran had a nutritive ratio of 1:6.07, the polish of 1:6.75 and the straw of 1;7.74. As the ratio best adapted for working farm animals has been shown to be 1:7, it would appear that in the case of the bran and polish there was not a sufficient discrepancy between the amounts of digestible albuminoids and digestible carbohydrates, while the reverse case is true with regard to the straw.

DIGESTION EXPERIMENTS.

The digestibility of the albuminoids in the feeding stuffs wa determined by treatment with pepsin, solution corresponding

closely in composition and solvent or digestive power to the gastric juice, the most important of all the animal digestive fluids. The principal constituents of this juice are lactic and hydrochloric acids, and a subtance called pepsin, secreted in the lining of the stomach and possessed of wonderful digestive or peptonizing properties, especially as regards albuminoids.

Pepsin is at present largely prepared from the stomach of the pig (*pepsina porci*), and is frequently administered medicinally to aid or promote digestion.

The pepsin solution used contained ten (10) grams of scale pepsin in two (2) litres of water, acidulated with ten (10) grams hydrochloric acid—(Sp. gr. 1.1975)—and the finely ground material was kept at a constant temperature of 104 degrees, Fahrenheit, for two periods of twelve hours each, one-tenth (0.1) per cent. of hydrochloric acid being added at intervals of three hours, so that at the end of twenty-four hours (24) one per cent. (1) of the acid would be present.

As the principal function of the gastric juice is to digest albuminoids, only the result of the digestion of albuminoids is given in the statement of analysis.

It was found that the milled rice showed the highest percentage of digestibility of albuminoids, (83.11), while the rice polish ranked next in the digestibility of its protein (82.44.) The bran exhibited a close approximation of its digestion co-efficient to that of wheat bran, the former being 76.75 and the latter 78 as determined by practical feeding experiments. The percentage digestibilities of the hulls and straw were 26.64 and 38.98 respectively, thus indicating a very small proportion of assimilable albuminoids, the total albuminoids, themselves, being present in very small proportion. In addition, the large proportions o mineral matter, (13.85 per cent. in the hulls and 19.97 per cent in the straw) consisting chiefly of silica, furnish an argument against the use of these substances as feeding stuffs, and the consequent introduction of large quantities of indigestible and unassimilable matters into the animal stomach. It will be seen by reference to the tables of analysis that the ash percentages of these

substances are much higher than those of similar products of other grains. The proportion of albuminoids in the straw, however, compares fairly well with the amounts contained in the straw of wheat and oats. As is the case with all grains and forage plants, when maturity approaches, there is a concentration of the nutrient constituents in the seed of the plant, leaving the stems and blades some what impoverished, and consequently less adapted to use as feed stuffs.

HULL ASHES.

Below is given a detailed analysis of the hull ashes, as taken from the mill furnaces. It will be seen that silica (insoluble matter) predominates, and only very small proportions of phosphoric acid and potash, the fertilizing constituents of value in the ash of plants, are present.

ANALYSIS OF HULL ASHES.

Sand and Insoluble matter	87.05
Soluble Silica	0.29
Sulphuric Acid	1.11
Phosphoric Acid	0.82
Oxide of Iron, Alumina	0.98
Lime	0.85
Magnesia	0.56
Potash	0.93
Soda	0.64
Chlorine	0.11
Moisture	3.87
Unconsumed Organic Matter	2.86
Total	100.07

As the hulls themselves, when completely ignited in the laboratory, yield 13.85 per cent. mineral matter, we can approximately calculate the proportion of ashes obtained by burning the hulls at the mill. The ashes from the mill contain 6.73 per cent. of volatile and unconsumed organic matter together with hygro-

scopic moisture, leaving a percentage of 93.27 of mineral matter indicating 14.85 per cent. of crude ash obtainable from the hulls at the mill.

ABSOLUTE AND RELATIVE QUANTITIES OF THE PROXIMATE CONSTITUENTS IN THE SAMPLES ANALYZED.

According to data obtained from rice milling establishments, it appears that from 162 lbs. of rough rice, on an average, there are obtained :

95 lbs. of clean rice of all grades,
8 lbs. of polish,
30 lbs. bran, and
29 lbs. of chaff, straw, trash, dust, etc.

In the earlier part of the season, it is estimated that the proportion of bran obtained is 50 per cent. greater. Owing to the fact that the above figures represent only averages, and that the 29 lbs of straw, chaff, trash, etc., is so comprehensive as to include several waste products of no definitely known composition, the hulls alone having been analyzed, together with the fact that the products of rice when separated from each other, perhaps, have different hygroscopic capacities from those possessed in the rough grain, it has been difficult to obtain results from the chemical analysis of these products, coinciding precisely, in the aggregate, with the results of the analysis of the rough rice itself. In the 162 lbs. of the rough rice we find by determination and calculation.

8.83 lbs. of ash (mineral matter.)
4.18 lbs. of fat,
15.03 lbs of fibre,
12.05 lbs of albuminoids,
104.16 lbs of carbohydrates.

In like manner, in 30 lbs of bran we find

3.33 lbs of ash,
2.97 lbs. of fat,
3.28 lbs. of fibre,

13.81 lbs. of carbohydrates.

In 8 lbs. of polish there are contained

.44 lbs of ash,
.56 lbs of fat,
.21 lbs. of fibre,
.87 lbs. of albuminoids,
5.07 lbs. of carbohydrates.

In same manner, in 95 lbs. of clean rice there are

.69 lbs. of ash,
.36 lbs of fat,
.45 lbs of fibre,
7.15 lbs. of albuminoids,
74.15 lbs of carbohydrates.

Likewise in 29 lbs. of chaff or hulls we have

4.02 lbs. of ash,
0.25 lbs of fat,
11.06 lbs. of fibre,
.83 lbs. of albuminoids,
10.15 lbs. of carbohydrates.

In this enumeration of the absolute quantities of the several constituents, water is omitted, though it constitutes the balance necessary to make up the full weight of each substances considered. Combining the amounts of each proximate constituent contained in the quantities of these samples mentioned above, we find of ash,

3.33 lbs. in Bran,
.44 lbs. in Polish,
.69 lbs. in Clean Rice,
4.02 lbs. in Chaff.

Total 8.48 lbs. of Ash.

Found in 162 lbs. rough rice 8.83 lbs.

Of fats, there are

2.97 lbs. in Bran,
.56 lbs. in Polish,
.36 lbs. in Clean Rice,

.25 lbs. in Hulls.

Total 4.14 lbs. of fats.

Amount in 162 lbs. rough rice 4.18 lbs.

Of fibre, there are contained

3.28 lbs. in Bran,

.21 lbs. in Polish,

.45 lbs. in Clean Rice,

11.06 lbs. in Hulls.

Total 15.00 lbs. in fibre

Amount contained in 162 lbs. rough rice—15.03 lbs.

Of albuminoids, there are found

3.38 lbs. in Bran,

.87 lbs. in Polish

7.15 lbs. in Clean Rice,

.83 lbs in Hulls

Total 12.23 lbs. of albuminoids.

Amount contained in 162 lbs. rough rice 12.05 lbs.

In like manner, of carbohydrates, there are

13.81 lbs. in Bran,

5.07 lbs. in Polish,

74.15 lbs in Clean Rice,

10.15 lbs. in Hulls,

Total 103.18 lbs. carbohydrates.

Amount contained in 162 lbs. rough rice 104.16 lbs.

Converting these absolute amounts into percentages, we obtain the following relative distribution of the proximate constituents determined, in the several samples referred to.

Of the ash ingredients occuring in the rough rice, there are found

In the bran, 39.27 per cent of the whole amount,

In the polish, 5.19 per cent.

In the clean rice, 8.14 per cent.

In the hulls, 47.41 per cent.

Of the fats, there are contained,

In the bran, 71.74 per cent. of the total amount occurring in the rough rice,

In the polish, 13.52 per cent.

In the clean rice, 8.70 per cent.

In the hulls, 6.04 per cent.

Of fibre, there is found

In the bran, 21.89 per cent. of the total amount contained in the rough rice.

In the polish, 1.40 per cent.

In the clean rice, 3.00 per cent.

In the hulls, 73.73 per cent.

Of albuminoids, there are

In the bran, 27.64 per cent. of the total amount contained in the rough rice,

In the polish, 7.11 per cent.

In the clean rice, 58.46 per cent.

In the hulls, 6.79 per cent.

Of the carbohydrates, there occur

In the bran, 13.38 per cent. of the total amount in rough rice,

In the polish, 4.91 per cent.

In the clean rice, 71.87 per cent.

In the hulls, 9.84 per cent.

Comparing the composition of rice bran, with that of wheat and rye bran, we see that the latter contain larger proportions of carbohydrates and albuminoids, while in the former the fats, fibre and ash occur in greater quantities. On comparing the polish with wheat shorts, it is found that the polish contains larger amounts of carbohydrates, fats and mineral matter, while the shorts show larger percentages of fibre and albuminoids. The composition of both shorts and polish, as taken from different milling establishments, is somewhat variable, and appears to be to some extent dependant upon the mechanical processes of separation of these substances at the mills. The polish on being compared with oat meal, shows an almost perfect coincidence in the proportions of fats and carbohydrates present in the two substances, but the polish possesses less albuminoids and more mineral matter than the oat meal. It has been shown in a previous bulletin that rice bran and polish must be mixed in certain ratios with various hays and fodders, in order to obtain a feed stuff containing the nutrient constituents in the best relative proportions.

TABLE OF ANALYSES,

ANALYSIS OF THE AIR DRIED SUBSTANCE.

	SAMPLE.	Water.	Ash.	Fats.	Fibre	Crude Protein.	Carbohydrates.	Total Nitrogen.	Albuminoid Nitrogen.	True Protein.	Per cent. ratio true to crude protein.	Digestible Protein.	Per cent digestibility of Protein
1.	Rough Rice	10.95	5.45	2.58	9.28	7.44	64.30	1.19	1.134	7.09	95.29	5.58	75.00
2.	Rice from the Stones	12.12	2.55	2.10	3.03	8.09	72.11	1.295	1.29[illegible]	8.09	100.0[illegible]	6.36	78.68
3.	Pounded Rice	12.42	2 38	2.50	2.55	8.14	72.01	1.30	1.274	7.96	97.85	6.41	78.81
4.	Bran	10.67	11 .0	9.97	10.95	11.29	46.02	1.806	1.708	10.67	94.57	8.66	76.75
5.	Rice from cooling floor	12.75	0.82	1.05	0.72	7.74	76.92	1.24	1.19	7.44	96.12	6.3[illegible]	81.65
6.	Polish	10.63	5.45	7.02	2.62	10.94	63.34	1.75	1.736	10.85	99.18	9.01	82.44
7.	Clean Rice	12.85	0.73	0.38	0.47	7.52	78.05	1.204	1.148	7.17	95.48	6.25	83.11
8.	Hulls	8.27	13.85	0.85	38.15	2.89	34.99	.46	.46	2.89	100.00	0.77	26.64
9.	Straw	8.97	19.97	1.87	32.25	4.72	32.2[illegible]	.756	.756	4.72	100.00	1.84	38.98
	Wheat bran	12.08	5.84	3.67	8.55	14.82	55.04	----	----	----	----	----	----
	Rye bran	12.30	3.62	2.19	3.51	15.26	63.1[illegible]	----	----	----	----	----	----
	Wheat shorts	11.85	4.32	3.79	7.94	13.14	58.96	----	----	----	----	----	----
	Wheat straw	----	6.96	1.49	38.08	4.98	41.99	----	----	----	----	----	----
	Oat straw	----	4.72	2.07	42.78	3.35	36.97	----	----	----	----	----	----
	Rye straw	----	1.84	1.84	38.75	4.54	38.37	----	----	----	----	----	----
	Wheat chaff	14.30	6.50	2.30	27.10	9.50	40.30	----	----	----	----	----	----
	Oat chaff	13.60	11.00	1.40	31.70	4.90	37.40	----	----	----	----	----	----

ANALYSIS OF THE WATER FREE SUBSTANCE.

Sample.	Ash	Fats	Fibre	Crude Protein	Carbo-hydrates	Total Nitrogen	Albuminoid Nitrogen	True Protein	Digestible Protein
No. 1	6.12	2.88	10.42	8.24	72.34	1.32	1.27	7.86	6.26
No. 2	2.90	2.39	3.45	9.21	82.05	1.47	1.47	9.21	7.24
No. 3	2.72	2.85	2.91	9.29	82.23	1.49	1.45	9.09	7.32
No. 4	12.43	11.16	12.26	12.64	51.51	2.02	1.91	11.95	9.70
No 5	0.94	1.23	0.82	8,88	88.13	1.42	1.36	8.42	7.25
No. 6	6.10	7.85	2.93	12.24	70.88	1.96	1.94	12.14	10.09
No. 7	0.84	0.44	0.54	8.63	89.55	1.38	1.32	8.23	7.17
No. 8	15.10	0.93	41.59	3.15	39.23	0.50	0.50	3.15	0.84
No. 9	21.94	12.05	35.43	5.19	35.39	0.83	0.83	5.19	2.02

No. 25.

BULLETIN

OF THE

AGRICULTURAL EXPERIMENT STATION

WM. C. STUBBS, PH. D., Director and Official State Chemist.

ANALYSES OF

COMMERCIAL FERTILIZERS

AND

OTHER SUBSTANCES USEFUL TO AGRICULTURE.

ISSUED BY THE BUREAU OF AGRICULTURE,

T. J. BIRD, Commissioner.

PRINTED AT THE TRUTH JOB OFFICE.
BATON ROUGE, LA.

THE AGRICULTURAL EXPERIMENT STATION

OF THE UNIVERSITY OF LOUISIANA.

BUREAU OF AGRICULTURE.

GOV. F. T. NICHOLLS, President.

WM. GARIG, Vice-President Board of Supervisors.

T. J. BIRD, Commissioner of Agriculture.

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WM. C. STUBBS, Ph. D., Director.

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J. G. LEE, B. S., Assistant Director, Calhoun.

Assistant Director, Audubon Park.

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M. BIRD, B. S., Assistant Chemist.

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J. E. PRATT, Farm Manager, Baton Rouge.

L. M. CALHOUN, Farm Manager, Calhoun.

H. SKOLFIELD, Treasurer.

J. D. STUBBS, Secretary.

The bulletins and reports will be sent free of charge to all farmers, by applying to Major T. J. Bird, Commissioner of Agriculture, Baton Rouge, La.

OFFICE BUREAU OF AGRICULTURE,
Baton Rouge, La. Oct. ——, 1888.

To His Excellency Francis T. Nicholls, Governor of Louisiana and President of the State Bureau of Agriculture;

SIR:

In compliance with the provisions of Act 54, of 1889, herein please find the analyses made by Dr. W. C. Stubbs, Director and Official Chemist; also a list of the Commercial Fertilizers sold in the State during the season of 1888-89, their guaranteed analyses, names of the dealers to whom licenses have been issued, etc. The demand for fertilizers during the last season has decidedly increased. The general character of the article offered for sale has been fairly within the guarantee given. The costs of the different brands have varied but little from that of the previous season, and indications are that no material changes can be expected this season. There is also included in this report analyses of an agricultural nature made for the benefit of the public, which I am sure will prove instructive to the farmers and planters of this State.

Respectfully,

T. J. BIRD,

Commissioner Bureau of Agriculture.

LOUISIANA STATE UNIVERSITY AND A. AND M. COLLEGE,
OFFICE OF EXPERIMENT STATIONS.
Baton Rouge, La.

Major T. J. Bird, Commissioner of Agriculture, Baton Rouge, La.:

Dear Sir—I hand herewith the Analysis of Commercial Fertilizers made since our last report, together with the Fertilizer Law, with the request that you publish same as Bulletin No. 25. I have also included other analyses of an agricultural character made in the Station Laboratory, which may be of public interest.

Respectfully submitted,

WM. C. STUBBS, Director.

REPORT OF THE DIRECTOR.

The analyses contained in the report are of four kinds:

1. Of samples selected at the discretion of the Commissioner of Agriculture.

2. Of samples drawn by the purchaser, under regulations prescribed by the Commissioner of Agriculture.

The above are required by law.

3. Of samples used by the Stations.

4. Of samples sent by private parties.

While the Station is not required by law to work for private parties, yet all samples sent by individual citizens of the State will be analyzed without charge; *provided*, the means of the Station will permit; and *provided*, always, that in the discretion of the Director such analyses will be conducive to public welfare.

The Fertilizer Law is herein inserted for the guidance of the public. Under it, every citizen of the State is amply protected from fraud and imposition by unscrupulous dealers, and there exists absolutely no cause for distrust in the purchase of commercial fertilizers, if the farmer will but claim the protection afforded him. The sellers of good wares are also protected, as ample facilities are afforded them of properly advertising their goods.

Only cotton-seed meal, land plaster, salt, ashes, lime, and bones not specially treated, are exempt from the provisions of this law.

Bones ground to a powder by machinery, as well as *bones treated with acid*, are included in the law, since they *have been specially treted*

The following is the law:

Sec. 2. Be it further enacted, etc., That it shall be the duty of any manufacturer or dealer in commercial fertilizers, before the same are offered for sale in this State, to submit to Commissioner of Agriculture a written or printed statement setting forth: First—the name and brand under which said fer-

tilizer is to be sold, the number of pounds contained or to be contained in the package in which it is to be put upon the market for sale, and the name or names of the manufacturers, and the place of manufacture; Second—A statement setting forth the amount of the named ingredients which they are willing to guarantee said fertilizers to contain: (1) nitrogen, (2) soluble phosphoric acid, (3) reverted phosphoric acid, (4) insoluble phosphoric acid, (5) potash. Said statement, so to be furnished, shall be considered as constituting a guarantee to the puchaser that every package of such fertilizers contains not less than the amount of each ingredient set forth in the statement. This shall, however, not preclude the party making the statement from setting forth any other ingredient which his fertilizer may contain, which additional ingredient shall be considered as embraced in the guarantee above stated.

Sec. 3. Be it further enacted, etc., That every person proposing to deal in commercial fertilizers shall, after filing the statement above provided for, with the Commissioner of Agriculture, receive from the said Commissioner of Agriculture a certificate stating that he has complied with the foregoing section, which certificate shall be furnished by the Commissioner without any charge therefor. That the said certificate, when furnished, shall authorize the party receiving the same to manufacture for sale, in this State, or to deal in this State in commercial fertilizers. That no person who has failed to file the statement aforesaid and to receive the certificate of authority aforesaid, shall be authorized to manufacture for sale in this State commercial fertilizers. And any person so manufacturing for sale, in this State, or so dealing, without having filed the aforesaid statement, and received the certificate aforesaid, shall be liable for each violation to a fine not exceeding one thousand dollars, which fine shall be recoverable before any court of competent jurisdiction, at the suit of the Commissioner of Agriculture, or of any citizen, and shall be disposed of as hereafter provided.

Sec. 4. Be it further enacted, etc., That it shall be the

duty of the Bureau of Agriculture, or its Commissioners, at the opening of each season, to issue and distribute circulars, setting forth the brands of fertilizers sold in this State, their analysis as claimed by their manufacturers or dealers, and their relative and (if known) their commercial value.

Sec. 5. Be it further enacted, etc., That it shall be the duty of the Commisioner of Agriculture, under the regulations of the said Bureau, to cause to be prepared tags of suitable material with proper fastenings for attaching the same to packages of fertilizers, and to have printed thereon the word "guaranteed," with the year or season in which they are to be used, and a facsimile of the signature of said Commissioner. The said tags shall be furnished by said Commissioner to any dealer in or manufacturer of commercial fertilizers, who shall have complied with the foregoing provisions of this act, upon the payment by said dealer or manufacturer, to the said Commissioner, of fifty cents for a sufficient number of said tags to tag a ton of such commercial fertilizer.

Sec. 6. Be it enacted, etc., That it shall be the duty of every person, before offering for sale any commercial fertilizers in this State, to attach or cause to be attached, to each bag, barrel or package thereof, one of the tags herein before described designating the quantity of the fertilizer in the bag, barrel or package to which it is attached. Any person who shall sell or offer for sale, any package of fertilizer which has not been tagged as herein provided, shall be deemed guilty of a misdemeanor, and, on conviction thereof, shall be fined in the sum of two hundred and fifty dollars for each offense, and the said person shall be, besides, liable to a penalty of one hundred and fifty dollars for each omission, which penalty may be sued for either by the Commissioner of Agriculture, or by any other person for the uses hereinafter declared. Any person who shall counterfeit or use a counterfeit of the tag prescribed by this act knowing the same to be counterfeited, or who shall use them a second time, shall be guilty of a misdemeanor, and on conviction thereof, shall be fined in a sum not to exceed five hundred

dollars, one half of which fine shall be paid to the informer, which fine shall be doubled or trebled at each second and third conviction, and so on progressively, for subsequent convictions.

Sec. 7. Be it further enacted, etc., That all fertilizers or chemicals for manufacturing or composting the same, offered for sale or distribution in this State, shall have printed upon, or attached to each bag, barrel or package, in such manner as the Commissioner of Agriculture may by regulation establish, the true analysis of such fertilizer or chemical as claimed by the manufacturer, showing the per cent. of valuable ingredients such fertilizers or chemicals contain.

Sec. 8. Be it fnrther enacted, etc., That the Commissioner of Agriculture may obtain, or cause to be obtained, at his discretion, fair samples of all fertilizers sold, or offered for sale, in this State, from manufacturers or dealers, and shall have them analyzed by the official chemist, and shall publish the analysis for the information of the public.

Sec. 9. Be it further enacted, etc., That it shall be the duty of every person who sells a lot or package of commercial fertilizer, upon the request of the purchaser, to draw for same, and in the presence of the purchaser or his agent, a fair and correct sample, in such manner as the Commissioner of Agriculture may, by regulation, establish.

Sec. 10. Be it further enacted, etc., That the copy of the official chemist's analysis of any fertilizer or chemical, certified to by him, shall be admissible as evidence in any court of this State, on the trial of anything involving the merits of said fertilizer.

Sec. 11. Be it further enacted, etc., That the Bureau of Agriculture shall adopt needful rules and regulations providing for the collection of the money arising from the sale of tags, or from fines imposed under this act, and shall require the same to be deposited with the Treasurer of the State, and only to be drawn therefrom upon the warrants issued by the Auditor of the State upon the requisition of the Commissioner of Agriculture, made in pursuance of such rules and regulations; and the said Com-

missioner of Agriculture shall be entitled to receive no fees for collecting or disbursing said money, except his salary as provided for by law; but he shall be allowed a clerk at the salary to be fixed by the said Bureau, and to be payable out of the fertilizer funds; and all sums of money arising from the provisions of this act shall be known as the "Fertilizer Fund," and shall be kept by the Treasurer separate from other public funds, and shall be exclusively used, as far as they may go, to defray the expenses of developing agriculture by making practical and scientific experiments in relation thereto.

Sec. 12. Be it further enacted, etc., That for the purpose of making practical and scientific tests or experiments, it shall be the duty of said Commissioner, subject to the approval of said Bureau, to enter into contracts specifying the duration and conditions thereof, with a competent chemist and expert in experimental agriculture, to perform the duties of official chemist and to carry on and to conduct the experiment station established by said Bureau at Baton Rouge; and with the Louisiana Scientific Agritultural Association, having an experiment station in the Parish of Jefferson; and, in making such contracts, the said Commissioner shall provide that experiments be made for the development and benefiit of agriculture, especially in relation to the standard crops of the State, such as cotton, sugar, rice, corn, the cereals and grasses, and the like.

Sec. 13. Be it further enacted, etc., That as compensation for the conduct of such experiments, the Commissioner of Agriculture be and he is hereby authorized to apply the net result from the sale of tags, and from fines or penalties imposed for violations of the terms of this act, to the two stations, and, if necessary, parts of other sums that may be appropriated by law, and subject to the control of himself or said Bureau; provided, That said contract shall not give more than one-half of the results of the sale of tags, and fines, to any one of said stations; and provided further, That the said stations undertake to perform for and on behalf of the Commissioner of Agriculture, under such regulations as may be ageed on, all analyses required under this act free of any charge whatsoever.

Sec. 14. Be it further enacted, etc., That the Director of the State Experiment Station shall be considered as the official chemist of the Bureau of Agrigulture. He shall also attend such chemical and agricultural conventions as may be necessary; the traveling expenses incident to such attendance shall be chargeable and collectable from the revenues derived from the sale of tags.

Sec. 15. Be it further enacted etc., That the Commissioner of Agriculture shall keep a correct and faithful account of all tags received and sold by him, showing the number sold, to whom sold, and, as far as practicable, for what fertilizers they were intended to be used, and the amount of money collected therefor, and all money arising from fines, under this act.

Sec. 16. Be it further enacted, etc., That the term "commercial fertilizers," or "fertilizers," where the same are used in this act shall not be held to include lime or land plaster, cotton seed meal, ashes or common salt, or raw bone, not specially treated.

The following taken from a previous Bulletin, is herein inserted as explanatory of the terms to be subsequently used:

COMMERCIAL FERTILIZERS.

The ingredients which give value to all commercial fertilizers are, 1st, Nitrogen (Ammonia); 2d, Phosphoric Acid ; 3d, Potash. A fertilizer may contain one, two, or all of these ingredients. When all are present, the compound is usualy styled a "*complete* manure"; when only one or two are present, it is a *partial* manure."

Partial manures may consist of: (1), Nitrogen (Ammonia) alone; (2), Phosphoric Acid alone ; (3), Potash alone; (4), Nitrogen (Ammonia) and Phosporic Acid ; (5), Phosphoric Acid and Potash; (6), Nitrogen (Ammonia) and Potash. No. 6 is rarely found in Southern markets; the others are common wares.

(1.) NITROGEN MANURES.

Nitrogen is the most costly ingredient in manures. It is offered to the trade in three forms:

a.—Mineral Nirtogen—in Nitrate of Soda and Sulphate of Ammonia.

b.—Animal Nitrogen—in Dried Blood, Tankage, Azotin, Ammonite, Fish Scrap and Leather.

c.—Vegetable Nitrogen—in Cotton Seed, Cotton Seed Meal, Linseed Meal, Castor Pomace and Peat.

Blood Tankage, Fish Scraps and Oil Meals are highly active fertilizers, while Leather and Peat are slowly available. The result of decomposition of organic forms of Nitrogen is either Ammonia or Nitric Acid; fourteen parts of Nitrogen yielding seventeen parts of Ammonia, or twenty-eight parts of Nitrogen forming, by nitrification, one hundred and eight parts Nitric Acid. The mineral forms of Nitrogen are highly prized in the North and England; but in the South, on account of the ease with which they are washed from the soil, they should be used with great care.

Cotton-seed Meal contains, besides Nitrogen, small amounts of Phosphoric Acid and Potash. A fair sample of meal, *free from hulls,* should yield 7 per cent. Nitrogen, 3 per cent. Phosphoric Acid, and 2 per cent. Potash. This is a cheap source of Nitrogen, and experiments have demonstrated that it is, perhaps, the best form for Southern Agriculture. In buying it, however, *caution* is necessary to see that it is well decorticated, *i. e.*, free from hulls. Samples containing 30 per cent. of hulls have been found on the market.

(2.) PHOSPHORIC ACID MANURES.

These are generally phosphatic rocks treated with Sulphuric Acid. Sometimes pure bones or bone black, or bone ash, are treated with the same acid, and the resulting mixtures styled Dissolved Bones or Superphosphates. When made from phosphatic rock, bone black or bone ash, they contain only Phosphoric Acid. When pure bones are used, 3 to 5 per cent. of Ammonia is also found. These phosphatic manures usually contain their Phosphoric Acid in diffefent forms. Some of it is readily soluble in water, and is highly available as plant food; some of it is only soluble in acids, and is, therefore, only slowly, if at all, available to plants, while another portion is intermediate in solubility between the water soluble and the acid soluble. The chemist uses Citrate of Ammonia to dissolve this form; and hence it is denominated as Citrate Soluble Phosphoric Acid. It is believed by many that this form of Phosphoric Acid has resulted from a chemical action of the water soluble upon the acid soluble, and hence it is often called "*reverted,*" "*reduced,*" etc. The water soluble is readily available on all soils and by all plants; the citrate soluble in soils containing vegetable matter is believed to be available to many plants, while the acid soluble is immediately useful only to certain plants and upon certain soils. The water soluble and citrate soluble are usually taken together and called Available Phosphoric Acid. In buying

phosphatic manures, preference should be given, first to the water soluble, then to the citrate soluble. If there is much Acid Soluble Phosphoric Acid present, inquiry should be at once made as to its origin, for the Insoluble Phosphoric Acid from bones is more easily transferred into plant food than that from rock. These three forms of Phosphoric Acid are usually called "soluble," "reduced" and "insoluble."

(3.) POTASH MANURES.

These are now obtained almost exclusively from Leopoldshall and Stassfurth, Germany, and are largely sold in this country as (*a*) Kainite, which is a crude product of the mines, and consists of Potash, Magnesia, Soda, Sulphuric Acid and Chlorine. This form of Potash is now extensively used in the South, either in the compost of stable manure, cotton seed and Acid Phosphate, or mixed with Acid Phosphate and cotton seed meal to form a complete manure. Whether our soils need Potash can only be determined experimentally. After careful experimentation the right quantities can be easily determined. It is a cheap and an excellent source of Potash.

(*b*) Sulphate of Potash, a refined product containing a large amount of Potash in a very desirable form, is extensively used in some countries upon certain crops, notably tobacco and Irish potatoes.

(*c*) Muriate of Potash, another refined product containing a large percentage of Potash. This salt furnishes potash in the cheapest form.

(4) NITROGEN AND PHOSPHORIC ACID.

Formerly bones, treated with Sulphuric Acid, were frequently found upon our market; recently, however, Potash, in some form, has always been added to them. Whether this addition has been made by the demands of the soil or by the inclination of the manufacturers, is yet to be determined. Potash is the cheapest ingredient in fertilizers, and any demand for it is readily met. At present we find on our markets a manure of this class which is being extensively used under sugar cane, viz: *Tankage*. This is a variable goods, containing, usually, from 5 to 12 per cent. of Nitrogen, and from 6 to 20 per cent. Phosphoric Acid. This later is in the insoluble form; but, being of animal origin, upon certain soils is slowly available.

(5.) PHOSPHORIC ACID AND POTASH.

To make Acid Phosphates suitable for composting, many dealers have recently added Potash. This addition necessarily

lowers the percentage of Phosphoric Acid. Manufacturers in and around Charleston, S. C., have adopted the custom of calling this class of goods "Acid Phosphates," and those which contain no Potash, "Dissolved Bones." These are extensively used for the compost of stable manure and cotton seed.

(6.) NITROGEN AND POTASH.

The great and crying want of Southern soils is Phosphoric Acid; hence no manure without it has hitherto met with favor. Accordingly this class of manures is wanting in the South.

COMPLETE MANURES,

Are those which contain Nitrogen, Phosphoric Acid and Potash. For different crops these ingredients should exist in different proportions. Before purchasing any fertilizer, the farmer should study well the wants of his soil and his crop, and buy accordingly.

Before buying, get from the dealer replies to the following questions:

How much Soluble Phosphoric Acid do you guarantee?

How much Reverted Phosphoric Acid do you guarantee!

How much Ammonia do you guarantee?

How much Potash do you guarantee?

In a plain Acid Phosphate at least 12 per cent. available Phosphoric Acid should be guaranteed. In cane fertilizers, 3 3 per cent. Ammonia and 7 per cent. Phosphoric Acid, and in cotton fertilizers 2 per cent. Ammonia and 8 per cent. of Phosphoric Acid should be found.

EXPLANATION OF ANALYSES.

Nitrogen, Phosphoric Acid and Potash are the three ingredients which give value to commercial fertilizers, and are the only ones determined in official analyses.

Nitrogen is the most costly as well as the most valuable fertilizing ingredient. It occurs as Organic Nitrogen in animal and vegetable matters—easily decomposed and quickly available in blood and meat, slowly disintegrated, and of doubtful value in leather or peat unless specially treated.

All Organic Nitrogen is first converted into Nitric Acid or Ammonia in the soil or compost heap, before it can be used by plants. Nitric Acid and Ammonia are furnished in commerce, the one in the forms of Nitrates of Soda and Potash, the other as Sulphate of Ammonia.

Soluble Phosphoric Acid refers only to such phosphates as

are soluble in pure water and is made by treating bones, bone ash, bone black, or mineral phosphate with sulphuric acid. It is the chief ingredient of Acid Phosphates, Superphosphates or Dissolved Bones.

By Reverted Phosphoric Acid, reference is made to that form of acid which, though insoluble in water, is freely soluble in certain salts, particularly Citrate of Ammonia.

Insoluble Phosphoric Acid refers to that form that is soluble only in acids.

Potash is the ingredient usually found in ashes, and should be soluble in water.

VALUATION OF FERTILIZERS.*

The commercial value of a fertilizer is regulated by the prices demanded in commerce for the different forms of the three ingredients, Nitrogen (Ammonia), Phosphoric Acid and Potash. These prices fluctuate according to the demand and supply. In the North, Nitrogen is assigned a separate valuation for each of the forms—that in Nitrates and Ammonia Salts receiving the highest figure, and in leather and peat the lowest.

In Connecticut or Massachusetts, a determination of the forms in which this ingredient occurs must be made before its commercial value can be calculated. All the forms of Nitrogen have heretofore been considered of equal money value in the South, and but one price assigned. This, of course, precludes the existence of Nitrogen in form of leather dust, or powdered horn, forms regarded as unavailable and of little money or agricultural value.

The soluble and reverted forms of Phosphoric Acid have together been styled as "available," and assigned one value. The insoluble Phosphoric Acid has received no valuation. All forms of Potash soluble in water have been regarded as of equal value.

At a convention of Southern State Chemists, held at Athens, Ga., in 1886, the following tariff of prices was adopted:

Ammonia, 16 cents per pound.
Nitrogen, 19½ cents per pound.
Soluble Phosphoric Acid, 7½ cents per pound.
Reverted Phosphoric Acid, 7½ cents per pound.
Potash, (soluble in water), 5 cents per pound.

The writer, though not present at the convention, deems it best, for the sake of harmony in State valuations, to adopt this tariff for the present year, though he wishes to dissent from the opinion that Reverted Phosphoric Acid is of equal value as the soluble form, or that Nitrogen is of the same money value in all its forms.

The above are commercial values, that is what these ingredients, properly mixed and sacked. can be purchased for in the markets of the South. The above tariff, when applied to fertilizers bought in New Orleans, will be found to give values beyond the actual selling prices. Good cotton seed meal contains 7 per cent. Nitrogen, 3 per cent. Phosphoric Acid and 2 per cent. Potash, and estimating its value only on its content, there will be obtained for one ton 140 ponnds of Nitrogen at 19½ cents—$27 30. It is well known that this fertilizer could be bought at any time in the year, in New Orleans, at about $20 per ton.

This form of Nitrogen comes entirely from the South, while all others are products of Northern and foreign climes. Home consumption takes only a small portion of the output of our mills, the greater part finding its way to the North and to Europe.

This export demand regulates the price, and hence we have the cheapest form of Nitrogen presented to us in our own home product, viz: Cotton Seed Meal.

By applying the above to a fertilizer of known composition, and comparing the result with the actual selling price, the consumer can easily tell whether he is getting value received.

HOW TO COMPUTE THE VALUE OF A FERTILIZER.

A fertilizer is purchased whose guaranteed analysis recorded on the sack, is as follows:

Nitrogen, 3 per cent.
Soluble Phosphoric Acid, 6 per cent.
Reverted Phosphoric Acid, 4 per cent.
Potash, 2 per cent.

What is its commercial value?

IN ONE TON WE HAVE:

3 per cent. Nitrogen	60 lbs. at 19½ cents	$11 70
6 per cent. Soluble Phosphoric Acid,	120 lbs. at 7½ cents	9 00
4 per. cent. Reverted Phosphoric Acid	80 lbs. at 7½ cents	6 00
2 per cent. Potash	40 lbs. at 2 cents	2 00
Commercial value, per ton		$28 70

By comparing the above with the amount paid, the consumer can easily calculate whether he has paid too much.

The work done in the Laboratory of the Station, since our last report, September 1st. 1888, may be classified as follows:

2 Special Manures.
13 Ammoniated Superphosphates and Guanos.

5 Acid Phosphates.
7 Cotton-seed Meal.
3 Tankage.
1 Bone Meal.
1 Nitrate of Soda.
1 Sulphate of Ammonia.
1 Dried Blood.
2 Fish Scrap.
1 Bat Manure.
1 Garbage.
1 Pigeon Manure
1 Poudrette.
3 Natural Phosphates.
1 Land Plaster.
1 Cotton-seed Hull Ashes.
1 Limestone.
1 Marl.
1 Kainite.
1 Potassium Sulphate.
1 Glutin as a feed stuff.
1 Guano taken from ground the year after it was used.
1 Water.
3 Bituminous Coal.

SPECIAL MANURES.

These are prepared by manufacturers for special crops upon certain class of soils, from formulas furnished either by the planers, the Experiment stations, or some agricultural chemist. It is quite fashionable now, to prepare manures for every crop that is extensively grown, and it is claimed by the manufacturers that in so doing a vast saving is insured the agriculturist by furnishing him the right ingredients in the proper proportions for the crop to be cultivated. Such a practice, however, looks only to the requirements of the crop grown and ignores the natural capacity of the soil, to which it is to be applied. It is entirely irrational but in the absence of a knowledge on the part of the farmer of the contents of his soil and the requirements of his plants, it is to be recommended over the usual habit of buying our fertilizer for all kinds of crops.

While quite a number of special manures are manufactured in our State, only two have been sent to this station for analysis.

SPECIAL MANURES.

Station No. 193—Sugar Cane Special—prepared by Planter's Fertilizer Co., New Orleans, La., and sent by D. R. Calder, Franklin, La.

Station No. 194—Cotton Special—prepared by Planter's Fertilizer Co., New Orleans and sent by————

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Analyses of Special Manures.

Station Number	Nitrogen	Ammonia	Soluble Phosphoric Acid	Reverted Phosphoric Acid	Insoluble Phosphoric Acid	Total Phosphoric Acid	Potash	Relative Commercial value per ton.
193	3.22	3.91	6.91	.71	.31	7.93	2.05	$.6 04
194	2-38	2.89	7.98	.98	.23	9.19	1.96	24 44

Ammoniated Superphosphates and Guanos constitute the bulk of the fertilizers sold in our markets. They contain all three of the chief fertilizing ingredients and are then really complete fertilizers, though the proportions of these ingredients are by no means constant, varying according to the manufacturers' ideas of what constitutes a suitable fertilizer for our leading crops. Hence we find them varying largely in chemical contents and commercial value.

AMMONIATED SUPERPHOSPHATES AND GUANOS.

Station No. 186.—Bradley's Fertilizer ; manufactured in Boston by Bradley Fertilizer Co., and sent to the Station by Ames Bros., Milladon Plantation, La.

Station No. 187.—Bowdker's Fertilizer; manufactured by Browdker Fertilizer Co., of Boston, and sent to the station by Ames Bros., Milladon Plantation, La.

Station No. 189.—Ohlendorf's Dissolved Peruvian Guano ; made by Anglo Continental Works, London,

Guaranteed Analyses of Commercial Fertilizers, as Rendered to Commissioner of Agriculture by Dealers and Manufacturers to whom Licenses have been Issued for Season 1888-9.

NAME OF FERTILIZER OR CHEMICAL	BY WHOM REPORTED.		BY WHOM MANUFACTURED.	WHERE MANUFACTURED.	Weight of package lbs.	NITROGEN.	PHOSPHORIC ACID.			PATASH.
	NAME.	ADDRESS.					Solubl	Reverted	Insoluble	
Oats Fertilizer	Planter's Fertilizer Manufacturing Co.	New Orleans, La.	Planter's Fertilizer Manufacturing Co	New Orleans	100	4½ to 5	6	1	—	1 to 2
Rice Fertilizer	do. do.	" " "	" " " "	" "	100	4½ to 5	6	1	—	1 to 2
Fruit Tree Fertilizer	do. do.	" " "	" " " "	" "	100	4 to 5	5	1	—	4 to 5
Vegetable Fertilizer	do. do.	" " "	" " " "	" "	100	5 to 6	4	—	—	5
English Acid Phosphate	do. do.	" " "	" " " "	" "	100	—	14 to 15	—	—	—
German Kainit	do. do.	" " "	" " " "	" "	100	—	—	—	—	13
Armour's Powdered Bone	H. Studniczka	New Orleans, La.	Armour & Co	Chicago, Ill	200	3 to 4	—	—	28 to 30	—
Armour's Hog Tankage	do.	" "	" "	" "	200	7 to 8	*	*	2 to 3	—
Studniczka's Standard Cane Fertilizers	do.	" "	" "	" "	200	2½ to 3	*	*	2 to 3	—
Dissolved Peruvian Guano	C. C. Crawford	New Orleans, La	Anglo Continental Guano Works	London	168	7.40	8.25	†	†	2.16
Early Cane Manure	do.	" "	" " " "	do.	168	4.12	—	‡	‡	7
Special Cane Manure	do.	" "	" " " "	do.	168	7.40	8.25	†	†	3,79
Atlantic Soluble Guano	Pelzer, Rodgers & Co., Agents	Charleston, S. C.	Atlantic Phosphate Co	Charleston, S. C	200	1.64	6	2	1.50	2
Ammoniated Atlantic Dissolved Bone	do. do.	" "	" " "	" "	200	1.50	8	2	2	1
Atlantic Acid Phosphate	do. do.	" "	" " "	" "	200	—	8	2	2	1
Atlantic Dissolved Bone	do. do.	" "	" " "	" "	200	—	10	2	2	—
Carib Guano	Ben H. Pring	New Orleans, La	Imported by Carib Guano Co.	Baltimore	*200	—	—	—	—	—
Gossipium Phospho	Geo. W. Scott Manufacturing Company	Atlanta, Ga	Geo. W. Scott Manufacturing Co.	Atlanta, Ga	200	2.25	5.50	3.50	1.50	1.50
Scott's Animal Ammonia	do. do. do.	" "	" " " "	" "	200	.75	7.00	3.00	1.00	1.00
Scott's High Grade Acid Phosphate	do. do. do.	" "	" " " "	" "	290	—	8.00	5.00	2.00	—
Ammoniated Dissolved Bone	North Western Fertilizing Company	Union Stock Yards, Chicago, Ill.	North Western Fertilizing Co.	Union Stock Yard, Chicago, Ill	200	1.64	[illegible]	3½	2½	½
Pelican Sugar Cane Fertilizer	do. do. do.	" " " " "	" " " "	" " " "	200	1.64 to 2.45	5½ to 6½	2½ to 3	2½ to 3½	.54 to 1.08
National Bone Dust	do. do. do.	" " " " "	" " " "	" " " "	200	1.61 to 2.46	5½ to 6½	2½ to 3	2½ to 3½	.54 to 1.08
Stern's Ammoniated Raw Bone Superphosphate	Standard Guano & Chemical Manuf'g Co.	New Orleans, La	Standard Guano & Chemical M'f'g Co	New Orleans	200	1.64 to 2.47	9 to 13	—	1 to 3	1½ to 3
Acid Phosphate	do' do. do.	do.	" " " "	" "	200	—	12 to 14	—	1 to 6	—
Kainite	do. do. do.	do.	" " " "	" "	200	—	—	—	—	12
Pure Ground Raw Bone	do. do. do.	do.	" " " "	" "	200	2.88 to 3.20	—	—	23 to 24	—
Special Orders	do. do. do.	do.	" " " "	" "	—	—	—	—	—	—
Soluble Pacific Guano	Glidden & Curtis represented by	Boston, Mass	Pacific Guano Co., Boston, Mass	Wood's Holl, Mass	—	—	—	—	—	—
Cotton Grade	W. P. Richardson	33 Carondelet street, New Orleans	" " " "	Charleston, S. C. and	200	2.15	7	3	2	[illegible]
Sugar Grade	do. do. do.	do. do. do.	" " " "	Carribean Sea	200	2.47	6.50	2.50	2.75	3 50
Sugar Fertilizer	Planter's Fertilizer Manufacturing Co	New Orleans, La	Planter's Fertilizer Manufacturing Co	New Orleans	100	3 to 3¼	7	1	—	2 to 3
Cotton Fertilizer	do. do. do	do. do.	" " " "	" "	100	2½	9	1	—	2

* 9 to 11 per cent. Available Phosphoric Acid.
† 1.8 per cent. Reverted and Insoluble Phosphoric Acid.
‡ 9.16 per cent. Reverted and Insoluble Phosphoric Acid.

England, and presented to the Station by C. C. Crawford, Agent, New Orleans.

Station No. 190.—Ohlendorf's Early Cane Manure; made by Anglo Continental Works, London, England, and presented to the Station by C. C. Crawford, Agent, New Orleans.

Station No. 191.—Ohlendorf's 9 per cent. Ammonia; made by Anglo Continental Works, London, and presented to the Station by C. C. Crawford, Agent, New Orleans.

Station No. 203.—Guano sent by Mr. Cartwright Eustis, New Orleans.

Station No. 205.—Guano sent by Mr. Wm. B. Bloomfield, New Orleans, La.

Station No. 223.—Guano; sent by Mr. J. M. McBride, Ellendale, La.

Station No. 224—Guano; sent by Mr. J. M. McBride, Ellendale, La.

Station No. 225.—Stern's Ammoniated Superphosphate; made and sent by Standard Guano and Chemical Manufacturing Co., New Orleans.

Station No. 226.—Standard Soluble Guano; made and sent by Standard Guano and Chemical Manufatcuring Co., New Orleans.

Station No. 227.—Champion Farmer's Choice Guano; made and sent by Standard Guano and Chemical Manufacturing Co., New Orleans.

Station No. 231.—Nonpareille Guano; sent by J. J. Martin, New Orleans.

Analyses of Ammoniated Superphosphates and Guanos.

Station No.	Nitrogen.	Equivalent to Ammona	Soluble Phosphoric Acid.	Reverted Phosphoric Acid.	Insoluble Phosphoric Acid.	Total Phosphoric Acid.	Potash.	Relative Commercial Value per ton
186	2.66	3.23	8.11	2.10	1.69	11.90	3.04	$28.72
187	2.10	2.55	7.36	4.16	2.94	14.46	2.02	27.99
189	6.58	7.99	8.32	1.22	.96	10.50	3.16	43.13
190	2.56	3.11	3.68	.77	.67	5.12	7.52	24.16
191	7.14	8.67	9.60	1.73	.83	12.16	3.76	48.60
203	2.97	3.60	1.92	4.42	.70	7.04	----	21.08
205	5.95	7.22	----	----	----	13.2[illegible]	----	------
223	3.78	4.59	5.28	.30	2.02	7.60	.95	23.922
224	3.64	4.42	7.04	1.28	.38	8.70	.98	27.656
225	2.24	2.72	7.04	3.07	.64	10.75	1.76	25.661
226	2.38	2.89	7.20	2.85	1. 1	11.26	2.12	26.477
227	2.31	2.80	6.72	1.38	.35	8.45	1.97	23.13
231	2.94	3.57	5.28	2.63	1.05	8.96	3.78	27.111

ACID PHOSPHATES

Are phosphates made soluble by treatment with Sulphuric Acid. and contain usually only one ingredient, viz: Phosphoric Acid, This ingredient should be in a soluble or available form. There is a current belief that Phosphoric Acid from Bone is more valuable than that from rock. This is true only in regard to the insoluble forms of Phosphoric Acid. Soluble and reverted Phosphates are of equal agricultural value, whether from rock or Bone; and a good Acid Phosphate, whatever its source, should contain little or no Insoluble Phosphates.

ACID PHOSPHATES.

Station No. 176.—Rockdale Acid Phosphate; sent by Standard Guano and Chemical Manufacturing Co., New Orleans.

Station No. 177.—Capulet Acid Phosphate; sent by Standard Guano and Chemical Manufacturing Co., New Orleans.

Station No. 185.—English Acid Phosphate; imported; sent by Planter's Fertilizing Co., New Orleans.

Station No. 188.—English Acid Phosphate; imported; sent by Planter's Fertilizing Co., New Orleans,

Station No. 207.—English Acid Phosphate, imported; sent by Planter's Fertilizing Co., New Orleans, La.

Analyses of Acid Phosphates.

Station No.	Soluble Phosphoric Acid.	Reverted Phosphoric Acid	Insoluble phosphoric Acid.	Total Phosphoric Acid.	Relative Commercial Value Per Ton of 2000 lbs.
176	12.41	1.34	.69	14.44	$20 62
177	12.1[illegible]	2.07	.81	15.16	21 48
185	12.48	1.03	.95	14.46	20 26
188	14.31	.84	.41	15.56	22 72
207	13.76	1.10	.16	15.02	22 26

The prevailing prices of above goods in New Orleans during the past year have been below the above estimates.

COTTON SEED MEAL.

This is our cheapest and best source of Nitrogen. It is largely used all over Louisiana as a fertilizer. Being a feed stuff, it is excluded from the provisions of the Fertilizer Law. Hence, great care is necessary, in its purchase, to see that it is well decorticated, *i. e.* free from hulls. Pure, undamaged meal should be dry, pulverulent, and of a bright yellow color. Hulls in the meal can easily be detected by close examination, or by running a small quantity of meal through a common kitchen sifter, when the hulls will separate. Damaged meal has a dark color, and while it is probably unfit for cattle food, it is rarely injured as a fertilizer. The commercial value of cotton seed meal, reckoned by our tariff, is far in excess of its actual value in New Orleans.

Station No. 184.—Cotton Seed Meal; sent by Daniel Thompson,

The best meal should always contain 7 per cent. Nitrogen, 3 per cent. Phosphoric Acid, and 2 per cent. Potash.

Pattersonville, La.

Station No. 211,—Cotton Seed Meal; sent by Troselair & Robechaux, Thibodeaux, La.

Station No. 212.—Cotton Seed Meal; sent by Troselair & Robechaux, Thibodeaux.

Station No. 214.—Cotton Seed Meal; presented to the Station by the Union Oil Co., New Orleans.

Station No. 216.—Cotton Seed Meal; sent by North Louisiana Experiment Station.

Station No. 220.—Cotton Seed Meal; sent by Dugas & LeBlanc, Paincourtville, La.

Station No. 222.—Cotton Seed Meal; sent by Wm. B. Bloomfield, New Orleans.

Analyses of Cotton Seed Meal.

Station.	Nitrogen.	Ammonia.	Total Phosphoric Acid	Potash.
No. 184	6.90	8.39	2.57	1.93
" 211	7.07	8.58	3.29	1.74
" 212	7.21	8.7[illegible]	3.42	1.74
" 214	7.00	8.50	3.16	1.67
" 216	7.14	8.67	3.16	1.56
" 218	7.42	9.01	3.29	1.85
" 220	6.79	8.24	3.55	1.93
" 222	7.24	8.79	3.04	1.74

TANKAGE.

This fertilizer is growing in popularity in this State, and its extending use attests its supposed profitable results. It varies greatly in composition, as the analysis below will show. It is a refuse product of the slaughter house, and consists essentially of bone and meat which collects at the bottom of tanks in which the wastes of slaughter houses are cooked to extract the grease. When bone predominates, the Phosphoric Acid content is large and the Nitrogen small, and the action of both is slow. When meat is the chief ingredient, the per cent. of Nitrogen is large and the Phosphoric Acid low, and the action, (especially of Nitrogen) is quite satisfactory.

TANKAGE.

Station No. 179.—Tankage; sent by A. A. Maginnis, New Orleans, La.

Station No. 219.—Tankage; presented to the Station by Standard Guano and Chemical Manufacturing Co., New Orleans.

Station No. 230.—Tankage; sent by Henry Studniczka, St. Louis, Mo.

Analyses of Tankage.

Station No.	Nitrogen.	Ammonia.	Total Phosphoric Acid.
179	4.41	5.37	19.19
219	5.88	7.14	11.26
230	5.32	6.46	8.26

In the tariff of prices no value is assigned the Insoluble Phosphoric Acid. In tankage the origin is chiefly bone, and the value of the latter depends largely upon the fineness of pulverization. Very finely ground bone becomes available in the soil far quicker than that that has been coarsely pulverized. The latter has little or no value as a fertilizer. Leaving out the phosphoric acid and estimating the commercial values of above from their Nitro-

gen content alone, we find a ton of each to be worth, No. 179, $16 80; No. 219, $22 93. and No. 230, $20 75. Great caution is needed in the purchase of this kind of fertilizer, since its varying composition can be detected only by chemical examination. Therefore, every purchase should be based upon a guaranteed content of both Nitrogen and Phosphoric Acid.

BONE MEAL.

Bones ground to a powder are largely used in some countries as a fertilizer, and are held in high esteem. They are not popular in the South. The more finely ground they are, the higher their commercial value. Hence, in estimating their value, both a mechanical and chemical analysis are necessary. The sample analyzed was presented to the Station by the Standard Guano and Chemical Co., of New Orleans:

ANALYSIS:

Station.	Nitrogen.	Phosphoric Acid.
No. 217	3.57 per cent.	20.99 per cent.

It's mechanical condition was fairly good.

NITRATE OF SODA

Is obtained from the nitre beds of Chili and Peru and is one of the most active forms of Nitrogen, and is hence used largely for top dressing small grains and grasses. It is subject to rapid loss by leaching, hence should only be applied to growing crops, or upon very stiff clayey soils, and then in limited quantities, at a time to insure the best results. The sample analyzed was presented to the Sugar Experiment Station by the Standard Guano and Chemical Co., of New Orleans, La.

ANALYSIS:

Station No. 209. Nitrogen 16.29 per cent.

Equivalent to Pure Nitrate of Soda, 98.90 per cent.

SULPHATE OF AMMONIA.

Is a by-product of the gas works of cities. It is made by treating the ammonical wash water with sulphuric acid, and then evaporating to dryness. Like Nitrate of Soda, it is an active

form of Nitrogen, and but slightly inferior to that salt in solubility and leaching property. It too must be handled carefully or else great loss may be sustained. The sample analyzed was made and presented by the Standard Guano and Chemical Co., of New Orleans.

ANALYSIS.

Station No. 213. Ammonia 24.82 per cent.
Equal to Sulphate of Ammonia. 96.37 per cent.

DRIED BLOOD

Occurs in commerce as black and red blood. The former has been prepared by drying the blood of slaughter houses by superheated steam, the latter at a lower temperature. The former is oflen lumpy, and shoulu be thoroughty pulverized before use. They both contain from 8 to 15 per cent. Nitrogen and are usually sold upon a guarantee of so many units of ammonia. This is a most excellent source of Nitrogen. Field and laboratory experiments have shown a slight degree of availability in favor of the red blood, due doubtless to its finer pulverization. One sample was presented to the Sugar Experiment Station by the Standard Guano and Chemical Co., of New Orleans.

ANALYSIS OF DRIED BLOOD.

Station No. 208. Nitrogen, 13.72 per cent.
Equal to Ammonia. 16.66 per cent.

FISH SCRAP.

Along the Atlantic coast from Maine to Florida are found numerous works engaged in extracting oil from fish. The residue after extraction of oil is dried and ground and sold in the markets either to the manufacturer as an ingredient of his wares, or to the farmer directly as a fertilizer. It constitutes the source of Nitrogen in many of our leading brands of commercial fertilizers. It contains a goodly per centage of both Nitrogen and Phosphoric Acid, and like Tankage it must be finely ground to produce the best results. It is one of the cheapest sources of Nitrogen. Both of our samples were sent by the

Standard Guano and Chemical Co., of New Orleans, and the latter presented to the station.

ANALYSES OF FISH SCRAP.

Station	Nitrogen.	Ammonia.	Phosphoric Acid.
No. 182	7.42	9.01	8.06
" 228	7.00	8.50	6.19

BAT MANURE.

The ordure of Bats often accumulates in large quantities in caves, roofs of houses, &c. When pure it is an excellent manure, but is often mixed with sand and other adulterants. The supply too is always limited. Our sample was sent by Messrs. Schmidt & Zeigler, Willswood Plantation, and contained an unusual quantity of Phosphoric Acid.

ANALYSES OF BAT MANURE.

Station No.	Nitrogen.	Phosphoric Acid.
181	1.26	11.78

GARBAGE.

A sample of fertilizer made from the Garbage of a northern city, under a new process, was sent to the Station by Mr. A. A. Maginnis, of New Orleans, who contemplated trying the same process on the garbage of the city, provided it proved of value as a fertilizer. Along with the fertilizer is extracted a considerable quantity of fat which could be used in soap making. The quantity of oil obtained and the quality and quantity of fertilizer will depend largely upon the character of the garbage. The following is the analysis: Nitrogen, 1.96 per cent. Phosphoric Acid, .55 per cent.; Potash, .96 per cent. and its commercial value, reckoning its Phosphoric Acid as "reverted," is $9.42 per ton.

PIGEON MANURE.

Sample sent by Trosclair & Robechaux, Thibodeaux, La., contained, Nitrogen, 2.54 per cent; Phosphoric Acid, 2.05 per cent.

POUDRETTE

Is prepared from night soils. Various patents and methods have

been used to successfully preserve the fertilizing ingredients of human excrement, and the latter thus preserved is sold as Poudrette. The substance varies greatly according to method of making it, and of quality of matter added. Sometimes a phosphate is used as a dryer which greatly increases the fertilizing value. An average Poudrette should contain from .9 to 2. per cent. Nitrogen, and 2 to 3 per cent. Phosphoric Acid. A large amount of Poudrette can annually be saved in every large city. Two samples have been analyzed :

Station No. 204.—Poudrette sent by C. W. Doughty, for Pelican Saw Co., New Orleans.

Station No. 232.—Poudrette (?) sent by J. J. Martin, New Orleans, La.

Analyses of Poudrette,

Station No.	Nitrogen.	Ammonia.	Soluble Phosphoric Acid	Reverted Phosphoric Acid.	Insoluble Phosphoric Acid.	Total Phosphoric Acid.	Potash.
204	.38	.46	....	....	....	....	....
232	.98	1.19	3.20	2.24	1.02	6.46	1.94

PHOSPHATES.

Under this head are included all of the natural Phosphates found on the small islands in the Caribbean Sea and elsewhere. They are deposits made by birds in a rainy climate, therefore the Nitrogen and soluble phosphates have been removed, leaving only the less soluble phosphates. Upon soils rich in vegetable matter, these phosphates may economically supplant the soluble phosphates, but for annual crops upon most of the soils of the South, the latter are to be preferred. The following have been analysed :

Station No. 180.—Swan Island Guano ; sent by F. S. Roberts. Mobile, Ala.

Station No. 192.—Grand Cayman Phosphate presented to the Station, by the Grand Cayman Phosphate Co., New York.

Station No. 200.—Phosphate, sent by Bradish Johnson, New Orleans, La.

Analyses of Phosphates.

Station No.	Soluble Phosphoric Acid.	Reverted Phosphoric Acid.	Insoluble Phosphate Acid.	Total Phosphoric Acid
180	......	4.30	17.90	22.20
192	......	3.59	22.57	26.16
200	......	.90	14.59	15.49

LAND PLASTER

Is the Sulphate of Lime. It is a stimulant manure and its effects are chiefly indirect. For leguminous crops, especially clover, it is largely used as a top dressing. In the South, however, it is not largely used, its benefits not being apparent. The following sample is not up to the best Nova Scotia plaster :

Station No. 198.—Land Plaster, sent by Planter's Fertilizer Co., New Orleans, Gave on analysis:

Water	18.32
Organic Matter	.72
Iron and Aluminium Oxides	1.75
Sulphuric Anhydride	34.94
Lime	24.01
Carbonate of Lime	13.91
Insoluble Matter	6.35
	100.00

COTTON HULL ASHES

Are in large demand in the Eastern States for growing tobacco, and command high prices. In the South they are not held in high esteem. They are not uniform in composition ;

the light colored being always richer in Potash than the dark colored. They are chiefly valuable for their large content of Potash. They contain also a goodly percentage of Phosphoric Acid. The sample analysed was not up to that usually found in the market.

Station No. 210.—Presented to the Station by Standard Guano & Chemical Manufacturing Co. New Orleans contained:

Phosphoric Acid	6.26
Potash	11.96

LIMESTONE.

The following sample came from Alabama and was sent with a view of determining its adaptability to making a lime suitable for sugar making. The small amount of insoluble matter and the high lime content, will make this a most excellent rock for sugar lime making.

Station No. 215.—Sent by J. B. Wilkerson, New Orleans, gave on Analysis:

Moisture	.24
Insoluble Matter	1.35
Lime	54.98
Carbon Dioxide	43.20

Equal to Carbonate of Lime 98.18 per cent.

MARL

Is a mixture of sand and clay with carbonate of lime. Sometimes it contains notable quantities of phosphoric acid and potash which greatly enhances its value as a fertilizer. Unless these substances are present in goodly quantities, it will rarely pay to transport any distance. Marls containing only carbonate of lime, must be used in large quantities to produce much effect; therefore it is rarely economical to haul even very short distances. The sample analysed came from Iberia Parish and contained Carbonate of Lime 33.48 per cent: and Potash .47 per cent.

KAINITE

Is a crude form of German Potash Salts taken from the

mines of Stassfurth or Leopoldshall and contains usually about 12. per cent. Potash. It has also goodly quantities of Magnesic and Sodic Chlorides. This is the form of Potash found in the markets of this State. Its use is often attended with no benefits.

Station No. 226. - Kainite, purchased by the Station, of the Planter's Fertilizer Co., New Orleans.

Analysis of Kainite.

Station No.	Potash.	Commercial value per ton.
206	12.14	$12 14

POTASSIUM SULPHATE

Is a refined product of the German Mines and is regarded as the best form of potash for many crops. It is also the most expensive form. The sample analysed was obtained from Standard Guano and Chemical Co., of New Orleans, and contained 41.98 per cent. of pure potash.

GLUTEN

Sent by Mr. D. D. Colcock, Secretary of Sugar & Rice Exchange, to test its comparative value with Rice Bran as a cattle food. It has already been reported in full in the Rice Bulletin No. 24. The following was the analysis :

Water	8.45	Per Cent.
Ash	1.15	Per Cent.
Albuminoids	30.81	Per Cent.
Crude Fibre	.77	Per Cent.
Fat	8.79	Per Cent.
Nitrogen Free Ext.act	50.03	Per Cent.
	100.00	

GUANO, TAKEN FROM THE GROUND,

Was sent by Mr. Wm. Polk, of Rapides, who wrote that this guano was applied to the stubble cane in the Spring of 1888, and the following Spring in breaking up the soil, he found the

layer of guano apparently as he had applied it. He took up carefully enough for a sample and sent to the Station. Analysis shows that it has lost nearly all of its Nitrogen. The soluble phosphoric acid has reverted. It is fair to presume that at least one-third of the Phosphoric Acid had remained unutilized. This suggests the necessity of a more thorough incorporation of our fertilizers with the soil in order to obtain the best results the first year. The analysis is as follows : Nitrogen .09 per cent. Reverted Phosphoric Acid 2.88 per cent. Insoluble Phosphoric Acid .70. per cent.

WATER

Mr. Leonce M. Soniat, of Dorceyville, La., has had bored near his sugar house a large artesian well which now furnishes all the water for his extensive sugar house. He sent a sample of this water for analysis to determine its fitness for use in his boilers. It contained 16.07 grains of solid matter per gallon. Of this 13 grains were mineral and 2.07 organic matter. The mineral matter contained very small quantities of lime and magnesia, ingredients which usually scale boilers. This is a most excellent water for manufacturing purposes and if the quantity proves adequate, Mr. Soniat's example will doubtless be soon followed by other progressive planters.

BITUMINOUS COAL.

The Corona Coal Co., of Alabama, sent the Sugar Experiment Station with their compliments, a car load each of Splint coal and Coalburg coal, with request that a full examination be made side by side with Pittsburg coal of their merits for steam making. They were both used under the boilers, and analyses made in the Laboratory. Pittsburg coal was also subjected to same tests. No. 196 burnt freely and made a good steam but gave a lot of ashes. No. 197 slaked so rapidly that only a small quantity could be used. This burnt well and gave steam freely. This rapid slaking will ever prevent the transportation of this coal to any distance. The following are the analyses :

COAL.

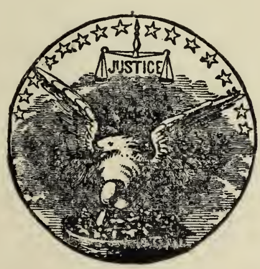
Station No. 195.—Pittsburg Coal; used by Sugar Station.

Station No. 196—Splint Coal; presented to the Station by Corona Coal Co.,

Station No. 197—Coalburg Coal; presented to the Station by Corona Coal Co.,

Analyses of Bituminous Coal.

Station No.	Water.	Combustable Matter.	Coke.	Ash.	Sulphur.
195	1.13	38.80	56.30	3.77	.60
196	1.88	37.32	52.80	8.	1.46
197	1.05	29.75	65.43	3.76	.81



BULLETIN No. 26.

REPORT

OF THE

STATE EXPERIMENT STATION,

AT

BATON ROUGE, LA.

FOR 1889.

WM. C. STUBBS, PH. D., Director and Official State Chemist.
D. N. BARROW, B. S., Assistant Director.

ISSUED BY THE BUREAU OF AGRICULTURE,
T. J. BIRD, Commissioner.

PRINTED AT THE TRUTH JOB OFFICE,
BATON ROUGE, LA.

THE AGRICULTURAL EXPERIMENT STATION,

LA. STATE UNIVERSITY AND A. & M. COLLEGE.

BUREAU OF AGRICULTURE.

GOV. F. T. NICHOLLS, President.

WM. GARIG, Vice-President Board of Supervisors.

T. J. BIRD, Commissioner of Agriculture.

STATION STAFF.

WM. C. STUBBS, Ph. D., Director,

D. N. BARROW, B. S., Assistant Director, Baton Rouge.

J. G. LEE, B. S., Assistant Director, Calhoun.

Assistant Director, Audubon Park.

B. B. ROSS, M. S., Chemist.

M. BIRD, B. S., Assistant Chemist.

A. T. PRESCOTT, M. A., Botanist,

H. A. MORGAN, M. S. Entomologist and Horticulturist.

W. H. DALRYMPLE, M. R. C.V. S.,Veterinary Surgeon.

A. M. GARDNER, B. S,, Farm Manager Audubon Park.

J. E. PRATT, Farm Manager, Baton Rouge.

L. M. CALHOUN, Farm Manager, Calhoun.

H. SKOLFIELD, Treasurer.

J. D. STUBBS, Secretary.

The bulletins and reports will be sent free of charge to all farmers, by applying to Major T. J. Bird, Commissioner of Agriculture, Baton Rouge, La.

LOUISIANA STATE UNIVERSITY AND A. AND M. COLLEGE,
OFFICE OF EXPERIMENT STATIONS,
Baton Rouge, La.

To Major T. J. Bird, Commissioner of Agriculture :

Dear Sir :—I hand you Annual Report of State Experiment Station for year 1889, by Mr. D. N. Barrow, Assistant Director, and ask that you publish it as Bulletin No. 26.

Respectfully submitted,

WM. C. STUBBS, Director.

LA. STATE UNIVERSITY AND A. & M. COLLEGE,
Baton Rouge, La., January 1890,

To Dr. W. C. Stubbs, Director :

Dear Sir :—Herewith I hand you report of Station No. 2 for the year just passed.

Very respectfully,

DAVID N. BARROW,
Assistant Director.

IRISH POTATOES.

Three sets of experiments with this crop were undertaken on this Station this year i. e. physiological, manurial requirements and varieties. A light rain, enough to produce germination, fell immediately after planting, but from that time until just before harvest there was not a drop. Hence the yields are much below what they probably would have been. This is quite unfortunate, as these experiments bid fair at the start to give some very interesting results.

VARIETIES.

There were ordered for delivery by March 1st, from Thorene E. Platt, of Pensylvania, some three hundred varieties of potatoes. These did not arrive until late in March, however, and it was the 22nd of that month before they were planted. The soil in which they were planted had been thoroughly prepared by a top dressing of well rotted stable manure plowed under in January. After deep and thorough pulverization of the soil the potatoes cut to two eyes, were planted under as near like conditions as possible. The cultivation was that ordinarily given. Time of ripening was noted and on June 21, and 23, all were dug despite the fact that some were still green, it being argued that a potatoe ripening later than this date was of no value here.

Below we give a table showing yield per acre in bushels of both merchantable and culls. The yields are calculated per acre in order to show the differences more plainly:

YIELD PER ACRE IN BUSHELS.

VARIETIES OF POTATOES.

No.	Name of Variety.	Mer.	Culls.	Remarks.
1	Lake Ontario	49.3	54.7	
2	Sutton's 100 Fold	32.1	34.	
3	Jones' Prize Taker	47.8	86.6	
4	Belle	35.6	56.	
5	Queen of the Valley	93.5	48.8	
6	Sutton's Exhibition Kidney	13.6	52.6	
7	Finck's Perfection	75.6	51.5	
8	Crown Imperial	0	86.7	
9	Ontario	17.8	54.9	
10	Chiticatica	28.0	35.7	
11	Canada Seedling	13.6	44.0	
12	Granger	0	37.4	
13	Cambrige Prolific	0	42.5	
14	Climax	0	52.7	
15	Crane's June Eating	14.1	44.	
16	Rand's 48	0	28.9	
17	First and Best	87.6	44.1	
18	Bliss' Triumph	98.6	71.4	
19	Bonanza	78.0	10.5	
20	Cowhorn	54.3	46.5	
21	Sunset	178 6	88.0	
22	Rankin's Racer	157.7	52.7	
23	Early Telephone	61.2	88.3	
24	Scotch Blue	69.8	79.9	
25	Duchess	20.3	40.8	
26	Banana	102.0	35.7	
27	Rose's Beauty of Beauties	45.8	83.3	
28	New Champion	25.5	39.9	
29	Morning Star	0	47.6	
30	Summit	25.5	68.0	
31	Late Beauty of Hebron	15.3	57.8	
32	*Brownells 55	0	51.0	
33	Pride of the Field	86.6	69.5	
34	Home Comfort	161.5	61.2	
35	Big Benefit	34.0	41.6	
36	Lee's Favorite	170.1	76.5	
37	Crown Jewell	90.1	83.3	
38	Early Puritan or Coy 49	100.3	73.0	
39	Dakota Red	91.8	91.8	
40	Barston	125.8	65.4	
41	Dictator	159.3	49.3	
42	Improved White Rose	81.6	60.3	
43	Brownells 31	25.5	5.1	
44	Ston's Seedling	39.0	62.8	
45	Charles Downing	30.6	74.0	
46	General Logan	41.6	77.3	
47	*Scotch Champion	22.9	70.1	
48	Harvard	134.3	51.0	
49	Nigh's Early Standard	178.6	87.4	
50	Mansons Seed	139.6	50.1	
51	*Scotch Hero	49.2	49.2	
52	Astonisher	110.5	26.3	
53	Early Snowflake	21.2	79.9	
54	*Manitoba	0	108.8	
55	Chaney Blow	115.6	67.1	
56	Well's Seedling	79.9	38.2	
57	Scotch Victoria	0	55.1	
58	Rocky Mountain Rose	26.3	61.2	
59	Early Rose	39.9	53.5	
60	Newton's Seedling	69.7	49.3	
61	Princess	23.8	73.1	
62	Highland Beauty	--------	34.8	Imported.
63	Winslow's Seedlings	75.6	57.1	
64	Prarie Farmer	46.6	57.8	
65	Salt Lake Queen	42.5	52.7	
66	Parson's Prolific	105.4	85.0	

YIELD PER ACRE IN BUSHELS.---Continued.

VARIETIES OF POTATOES.

No.	Name of Variety.	Mer.	Culls.	Remarks.
67	*Mexican	21.2	62.9	
68	Newton	117.3	64.6	
69	Arundel Rose	54.4	54.4	
70	Vick's Prize	29.1	42.5	
71	Prince Edwards Isle Champion	36.5	51.9	
72	Superior	22.9	37.4	
73	Vermont Champion	25.5	54,4	
74	Early Pearl	0	49.9	
75	James G. Blaine	13.6	54.4	
76	Brownell's Beauty	12.7	52.7	
77	Early Beauty of Hebron	40.8	62.0	
78	Gipsy	39.1	52.7	
79	*Silvers Chili	15.3	66.3	
80	Burpee's Empire State	62.9	71.4	
81	Potentate	79.9	48.0	
82	Moore's Seedling	79.9	78.2	
83	Conquest	92.6	28.9	
84	China	60.3	40.8	
85	White Whipple	12.7	78.2	
86	Pokeepsi White	29.7	42.5	
87	Matchlesss	39.9	41.3	
88	Eureka	0	59.5	
89	Mountain Rose	29.7	58.6	
90	Red Astrochan	41.6	42.5	
91	Platt's No. 503	299.2	93.5	
92	Mammoth Pearl	31.4	29.7	
93	Rose's New Seedling	0	25.5	Injured by fire.
94	Intermediate	0	33.1	do.
95	Sunlit Star	56.1	53.5	
96	Sword Potatoe	33.1	73.1	
97	Rural Blush	38.2	81.6	
98	*German White	0	0	Injured by fire.
99	*Mahopee	0	0	do.
100	*Heath Belle	0	0	do.
101	NeFaden's Seedling	20,8	35.7	
102	Orange Co. White	67.1	88.4	
103	*Statfield's Seedling	24.6	58.6	
104	*White Star	16.1	33.1	
105	Early King	0	60.6	Injured by fire.
106	Early Ohio	13.6	49.3	do.
107	American Grant	69.7	39.9	
108	Adirondac	62,9	51.0	
109	Mulaly	76.5	54.4	
110	White Mountain	84.2	50.7	
111	State of Maine	13.6	45.9	
112	*Stuben Chief	11.9	22.9	
113	Jersey Blue	0	0	
114	Thorburn	45.9	59.5	
115	Enos Seedling	54.4	70.5	
116	Chicago Market	22.9	79.9	
117	Brownell's Success	15.3	66.3	
118	White Chief	0	59.5	
119	Seneca Red Jacket	42.5	43.3	
120	Putnam's New Seedling	37.4	93.3	
121	Queen of Roses	73.1	79.9	
122	Charter Oak	28.9	83.3	
123	*Red Cloud	0	68 5	
124	*Tyrian Purple	0	37.4	
125	Iowa Beauty	25.5	46.7	
126	*Red Peach Blow	0	0	
127	Boston Market	79.9	92.6	
128	Early Waterford	76.5	62.9	
129	Perfect Gem	39.1	65.4	
130	*Calico	0	42.5	
131	Steuben Beauty	39 1	69.7	
132	Early Sands	112.2	59.5	

YIELD PER ACRE IN BUSHELS---Continued.

VARIETIES OF POTATOES.

No.	Name of Variety.	Mer.	Culls.	Remarks.
133	Lion	16.1	52.7	
134	Burbank's Seed	66.3	61.2	
135	Weld's Jumbo	22.9	79.0	
136	*Indian Beauty	27.2	50.1	
137	Callum's Superb	49.3	69.7	
138	Andross' Seedling	35.7	93.5	
139	Alexander's Prolific	85.8	93.5	
140	Baker's Imperial	76.5	81.6	
141	Whepple's Seedling	23.8	86.7	
142	Chicago Beauty	16.1	66.3	
143	Connecticut	11.9	54.4	
144	Early Dawn	69.7	66.3	
145	Thunderbolt	68.8	84.1	
146	Nevada White	98.6	39.1	
147	Lady Truscott	8.5	61.2	
148	*Scotch Highlander	0	9.3	
149	Peek	15.3	40 8	
150	Kampden Beauty	142.8	61.2	
151	Pride of Palestine	48.4	99.4	
152	Compton's Surprise	40.8	77.3	
153	Pride of Lisbon	80.7	53.5	
154	*Early New Zealand	14.4	39.9	
155	Maiden's Blush	39.1	40.8	
156	Advance	42.5	74.8	
157	Paragon	65.4	68.8	
158	Leopard	51.0	103.7	
159	White Beauty of Hebron	56.1	81.6	
160	*Peerless	0	71.4	
161	White Flower	76.5	78.2	
162	Early Vermont	169.1	37.4	
163	Churchill's Seedling	172.5	85.8	
164	Tunix	124.9	72.2	
165	English Kidney	45.9	105.4	
166	Old Orange Pink Eye	24.6	42.5	
167	Late Ohio	35.7	41.6	
168	Early Mayflower	66.3	70.7	
169	Irish Cup	76.0	54.4	
170	Idaho	131.7	79.0	
171	Garfield	38.8	92.6	
172	Early Essex	31.4	59.5	
173	Strawberry	56.9	63.9	
174	Capt. Sheaf	132.6	73.1	
175	Cayuga	173.4	24.6	
176	Rochester's Favorite	117.1	86.7	
177	Acme	21.	57.4	
178	Vanguard	65.4	76.2	
179	Irish Champion	0	73.1	
180	Late Rose	154.7	87.5	
181	Knapp's Snowbank	145.3	45.9	
182	Buffalo Beauty	163.2	63.7	
183	Dakota Red	104.5	51.0	
184	Crandall's Beauty	35.7	26.3	
185	Sutton's Magnum Bonum	8.5	85.0	
186	Early Electic	86.7	73.1	
187	Ruby	102.2	85.0	
188	Silver Skin	151.3	109.6	
189	Tollers	84.1	73.1	
190	Everitt	36.5	88.4	
191	Crimson Beauty	52.7	73.9	
192	Platt's 511	98.6	81.6	
193	Crane's Keeper	103.2	56.1	
194	Burpee's Superior	169.7	45.0	
195	Ash Leaf Kidney	45.0	100.3	
196	Weld's 22	62.0	34.0	
197	Champion of America	48.2	41.6	
198	Vermont's Snow Flake	62.0	101.1	

YIELD PER ACRE IN BUSHELS---Continued.

VARIETIES OF POTATOES.

No.	Name of Variety.	Mer.	Culls.	Remarks.
199	Ice Cream	64.6	77.3	
200	Red Elephant	91.8	59.5	
201	Rhinebeck	65.2	59.5	
202	Bermuda White	50.1	52.7	
203	Wall's Orange	28.9	62.0	
204	Carter	100.3	81.6	
205	Rural	140.2	52.7	
206	Platt's No. 40	52.7	52.7	
207.	Rose's Invincible	37.7	59.5	
208	McClue's Early	35.7	65 4	
209	Champlain	53.5	45.9	
210	Michigan White	79.0	40 8	
211	Red Star	139.8	57.8	
212	Garrison's Seedling	78.2	67.1	
213	Norway Mountain Rose	45.9	91.8	
214	Harmony	14.1	85.0	
215	McVeer's Peach Blow	67.1	45.9	
216	Early Blue	46.7	75.6	
217	American Magnum Bonum	147.6	66.3	
218	James Vick	99.4	65.4	
219	Ohio Queen	49.3	66.3	
220	Scotch Buffura	83.3	38.2	
221	Marvel of Beauty	48.0	38.2	
222	Ran's 42	70.5	73.1	
223	Pride of Erin	83.3	108.8	
224	Hercules	83.3	60.3	
225	Centenial	52 7	38.2	
226	Irish Beauty	51.0	82.4	
227	Platt's No- 84	29.7	79.9	
228	Early Maine	73.1	77.3	
229	Dunmoore	154.7	86.7	
230	Sir Garnet Wolsey	22.1	36.5	
221	Farinos	66.3	66.3	
232	Biscuit	22.1	56.1	
233	Vick's Extra Early	25.5	60.3	
234	Brook's Seed	143.5	78.2	
235	Lady Finger	28.9	113.0	
236	Early Perfection	187.8	78.2	
237	Spaulding	18.7	103.7	
238	Early Albino	93.5	68.2	
239	New Conqueror	79.9	42.5	
240	Rose's New Giant	142.5	80.0	
241	Rill's No. 1	51 0	69.7	
242	Early Favorite	87.5	100.3	
243	Cheesman's Seed	149.6	73.1	
244	Andrew's White Rose	30.6	42.5	
245	Platt's No. 80	0	130.0	
246	New Queen	78.2	79.9	
247	Victor	122.4	53.5	
248	Defiance	68.8	51.8	
249	Alpha	14.4	23.8	
250	Rose of Hebron	18.7	96.0	
251	St. Patrick	72.2	61.2	
252	Pride of America	68.0	79.0	
253	Crawford's Seedlings	99.4	28.0	
254	Snow Queen	95.2	72.2	
255	Jordon Russet	78.2	42.7	
256	Hale's Early Peach Blow	40.8	23.8	
257	Mitchell's Seedlings	91.8	34.0	
258	Platt's 512	0	72.2	
259	Pearl of Savoy	107.1	72.2	
260	El Passo	0	33.3	
261	* Late Blue	0	21.2	
262	Late Snowflake	11.9	68.0	
263	*Platt's No. 5	0	21.2	
264	Dun's Seed	129.2	66.3	

YIELD PER ACRE IN BUSHELS---Continued,

VARIETIES OF POTATOES.

No.	Name of Variety.	Mer.	Culls.	Remarks.
265	Carpenters Seed	139.4	51.0	
266	Stanton Seed	135.0	105.4	
267	Durham	49.1	90 1	
268	Early Household	43.3	100.3	
269	Lopume Triumph	65.4	38.2	
270	American Monarch	81.6	75.6	
271	Black Machanic	49.3	76.5	
272	Tonhocks	98.6	64.6	
273	Gold Band	106.4	76.5	
274	Pride of the West	36.5	63.7	
275	King of the Earlies	45.9	45.0	
276	Sylvian	111.3	83.3	
277	Peerless Peachblow	56.9	35.7	
278	White Elephant	108.8	87.5	
279	Bermuda	28.0	37.4	
280	Junkis	41.0	55 2	
281	Natt's Victor	72.2	97.3	
282	Late Favorite	118.1	72 2	
283	Tremont	72.2	81.6	
284	Weston's Seedling	72.2	75.3	
285	Davenport	9.3	88.6	
286	Early Gem	46.7	59.5	
287	Webb's Early	76.5	85.0	
288	Brownell's Best	86.7	78.2	
289	Great Fastern	153.8	41.8	
290	Jumbo	122.4	56.1	
291	Carless Matchless	37.4	80 7	
292	Yosemite	44.2	59.5	
293	Rosy Morn	113.9	71.4	
294	Little Grant	100.3	64.6	
295	Chief	153.0	120.7	
296	*Peterson's White	0	0	
297	Burrough's Garfield	39.9	79.9	
298	Clark's No 1	22.1	103.7	
299	Black McVeer	15.1	76.5	
300	Green Mountain	122.6	83 3	
301	Swedish Rose	49.1	85.0	
302	Iroquoise	9.3	56.1	
303	Cream of the Field	22.1	70.5	

*Not ripe when dug.

By examining these tables it will be seen that only fifty-five out of the three hundred and three varieties, or 18 per cent., gave a yield of 100 bushels or over, per acre. But even of these a number are valueless as the amount of culls is equal to, or very near equal to, the yield of the merchantable. Each variety was accurately described both before planting and after digging. Below is a description of the varieties of most promise:

EARLY SANDS—Rather disk shaped, white and smooth. Eyes few but deep. Ripe June 3.

GREAT EASTERN—Round and white skin, slightly russetted. Eyes very numerous and well marked. Ripe June 12.

CAYUGA—Long and round, white, smooth skin, deep eyes. Very fine. Ripe June 12.

BANANA—Broad and thick, white skin, smooth. Eyes numerous and poorly marked. Ripe June 7.

AMERICAN MAGNUM BONUM—Large, round, white, smooth, few eyes, very good. Ripe May 25.

PLATT'S NO. 503—Round white, smooth. Eyes few but well marked. Ripe June 12.

WHITE ELEPHANT—Large, white and round, quite smooth, eyes, few and well marked, scabby. Ripe May 25.

RURAL—Large, white, smooth, oval, with few eyes, fine. Ripe June 7

SYLVAN—Irregular shape, white, russetted. Eyes numerous. Ripe June 12.

GOLD BAND—White, with numerous well marked pink eyes. Skin smooth, scabby. Ripe June 3.

BROOKS' SEED—Large, irregular potato, with a smooth, white skin, quite scabby. Ripe June 7.

DICTATOR—Round, smooth and white. large and good. Ripe June 3.

ASTONISHER—Pink, heart shaped russetted. Eyes, few and shallow, of good size. Ripe June 7.

LEE'S FAVORITE—Oval and white, smooth skin. Eyes deep. Large and good. Ripe June 3.

LATE FAVORITE—Large andsmooth, white round, good. Ripe June 7.

EARLY VERMONT—Oval, dark pink, russetted. Eyes numerous. Very fine. Ripe May 25.

CRANE'S KEEPER—Irregularly, round, smooth, white. Ripe May 29.

EARLY PERFECTION—Large, round, pink, smooth. Eyes deep. Fine. Ripe May 29.

DAKOTAH RED—Large, irregular, red, russetted. Eyes deep and numerous. Ripe June 3.

CARPENTER'S SEED—Long, oval and white, eyes few, slightly russetted, good and very pretty. Ripe June 29.

HARVARD—Large, cylindrical. Deep eyes and numerous. White and smooth. Ripe June 15.

CHEESMAN'S SEED—Irregular, round, russetted, white, good. Ripe May 29.

CHURCHILL'S SEEDLING—Large and flat, smooth, white, somewhat scabby. Ripe May 25.

VICTOR PURPLE—Round, russetted. Few deep eyes. Ugly. Ripe June 3.

KNAPP'S SNOWBANK—Large, white, smooth, egg-shaped. Eyes few. Ripe June 12.

BUFFALO BEAUTY—White, round, smooth, Few eyes, good. Ripe June 7.

HOME COMFORT—Long and pink, smooth. Eyes few and well marked. Ripe June 7.

KNIGHT'S EARLY STANDARD—Long, white, slightly russetted. Eyes deep and numerous. Very good. Ripe June 10.

MURFREE'S SUPERIOR—White, irregular and russetted. Large and fine. Ripe June 7.

RED STAR—Broad and flat, pink, smooth. Numerous well marked eyes. Ripe June 7.

HAMPDEN BEAUTY—Egg-shaped, white, russetted. Poorly marked eyes. Ripe June 12.

RANKIN'S RACER—Oblong, pink, slightly russetted. Well marked eyes. Ripe June 7.

This table only goes to show how much the potato is influenced by a change of soil and climate. Some of the most cele-

brated potatoes in the East and West have been a total failure here, while others "to fame unknown" have done excellently. In order to repeat this experiment (it is to be hoped) under more favorable conditions of weather, all the varieties have been replanted this fall. The products of this crop will be saved until next spring.

EXPERIMENTS IN FERTILIZING.

In order to ascertain the manurial requirements of the potato in this soil seven experiments with fertlilizers were made. At the same time it was endeavored to ascertain whether different varieties, varied in these requirements. Below is a table giving results.

The low yield of cotton seed meal is due largely to the fact that that portion of the plant was from its position badly drained.

EXPERIMENTS IN FERTILIZING POTATOES.

YIELD IN BUSHEL PER ACRE.

HOW FERTILIZED	1000 lbs Cotton seed meal.		500 lbs Acid phosphate.		500 lbs Kainite.		Nothing.		1000 lbs Cotton seed meal; 500 lbs Kainite.		1000 lbs Cotton seed meal, 500 lbs Acid phosphate,		1000 lbs Cotton seed meal, 500 lbs kainite, 500 lbs Acid phosphate.	
Name of variety.	Mer.	Culls.	Mer.	Culls.	Mer.	Culls.	Mer.	Culls.	Mer.	Culls.	Mer.	Culls.	Mer.	Culls.
Extra Early Vermont	67	189	65.5	108.5	80.5	86.5	67	134	285.5	190.5	214	165.5	279.5	96
Nova Scotia Rose	124.9	151.5	88.0	143.5	143.0	98	144.5	85	246.5	217	300	151.5	448.5	187.5
Mammoth Pearl	125.0	128.0	82.0	169.5	183.0	53.5	200.5	59.5	439.5	159.0	368.5	114.5	376.0	132.5
Early Beauty of Hebron	110.0	74.5	132.5	70.0	144.5	58.0	184.5	89.5	456.5	76.0	445.5	70.0	356.5	191.0
Early Sunrise	215.5	101.0	192.0	83.5	147.5	71.0	154.5	91.0	407.0	113.0	460.0	101.0	444.0	04.0
Early Snowflake	242.5	150.0	177.0	89.5	168.0	113.0	160.5	148.5	312.0	135.5	383.5	129.5	588.0	140.0
Burbank	220.0	169.5	211.0	99.5	211.0	67.0	336.0	73.0	453.0	110.0	500.5	119.0	490.0	141.5
White Star	120.5	196.0	147.0	122.0	162.0	86.5	264.5	850.0	377.5	120.5	324.0	147.0	514.0	123.5
Peerless	218.5	101.0	150.0	104.0	217.0	62.5	143.0	140.0	438.5	104.0	232.0	193.5	511.0	174.5

After a cursory glance at this table it would appear that neither cotton seed meal, acid phosphate nor kainite alone have done any good, as in nearly every instance the yield of the "nothing" plat is equal to or in some instances exceeds the yield of these respective fertilizers. This is explained, however, by the fact that that portion of the plat was not in as fine a condition as the rest. In the case of kainite, a poor stand may also in part account for this. This only serves to emphasize what has heretofore been said i. e.: That unless potash fertilizers are thoroughly mixed with the soil they will destroy the stand. Despite the pains that was taken to thoroughly mix the kainite with the soil some of it evidently came in contact with the potato and destroyed it. Now by a closer study of this plat, it will be seen that the yield is largely increased from "nothing" out, and this when the soil was of about equal quality. With five out of the nine varieties, the combination of 1000 pounds of cotton seed meal, 500 pounds of acid phosphate and 500 pounds of kainite gave the best yield. The meal and acid phosphate predominates in two instances, as does also meal and kainite.

In five cases the meal and kainite gives a larger yield than meal and acid phosphate, despite the fact that the stand of the former was inferior. This would seem to indicate that potash is of some benefit. It is well to say just here that this is the first time in this station's experience that this has been the case.

There seems to be nothing to indicate that varieties are influenced by different fertilizers.

PHYSIOLOGICAL EXPERIMENTS.

In order to test the question as to which is the best form in which to plant the potato—whole or cut,—and what influence the size of seed has upon the yield, the following experiments were made:

The largest potatoes of the seven different varieties were carefully selected. These in their turn were assorted into three lots i. e.: Those weighing over 7 ounces, those between 5 and 7, and those between 3 and 5. Other potatoes of each lot were

divided in halves, others into four pieces, others were cut to pieces containing two eyes, and, lastly, one eye.

Each lot was carefully planted under as near like conditions as possible, on well prepared land. The whole potatoes were placed one foot a part, while the cuts were ten inches. All were carefully covered with a hoe and received the same after cultivation. The largest whole potato was the first to germinate, the next in size next, and so on down, until it reached the one eye cut, the last to germinate. This difference was maintained during the period of growth. The vigorous growth of the whole potato was in marked contrast to the sickly struggle for existance of the one and two eye cuts. In the case of the whole potato and also the halves and quarters when they were dug tubers in a more or less state of development were found on each vine. It is very much to be regretted that the severe drought came on just when these experiments needed rain most, and hence the difference in the yields is not as great as it would otherwise have been. A seasonable rain would very materially have reduced the number of culls and increased the merchantable in the large potatoes. It is true that the chances were equal, but in case of the large potato there were so many small ones, evidently stunted by the drought. While the increase of the large over the cut potatoes in this instance is not sufficient to make their planting economical, yet had the season been more favorable the results would have been different. It must also be remembered that in planting the potato whole, they should be placed at least 12 inches apart. thus not requiring as many hills as in the case of cuts. Below is a table of results :

PHYSIOLOGICAL EXPERIMENTS IN POTATOES.

BUSHELS PER ACRE.

Variety.	Potato over 7 ozs		Potato over 5 & under 7 ozs		Potato over 3 & under 5 ozs		Half potato		Quarter potato		Two eyes		One eye		
	Mer	Culls	Mer	Culls	Mer	Culls	Mer	Culls	Mer	Culls	Mer	Culls	Mer	Culls	Ripe
Thorbum	136.6	102.7	123.5	103.3	77.6	84.1	41.7	67.1	27.0	57.9	17.7	51.8	15.2	50 3	May 20
Rural Blush	195.7	73.2	190,1	56.8	79.4	61.1	116.9	57.9	105.2	42.7	126.5	35.0	47.2	7.6	June 10
Beauty of															June 10
Hebron	160.7	111.5	146.5	64.3	110.4	57.8	71,6	80.8	91.5	61.0	85.4	42.7	47.2	39.6	May 20
Peerless	114.8	145,4	114.8	87.4	97.1	87.4	116.5	54.9	99.1	32.0	76.2	32.0	61.0	18.3	May 20
Early Rose	103.7	106.0	70.0	128.9	86.2	86.2	71.6	135.7	76.2	56.4	29.9	32.0	32.0	42.7	May 15
Exta Early Vermont	66.6	151.9	100.5	146.5	72.1	91.8	42.7	111.3	96.0	76.2	103.7	48.8	35.0	27.4	May 20
Burbank's Seedling	134.4	109,3	113.7	163.4	51.1	133.3	86.9	80.1	81.6	79.3	62.5	79.3	59.4	289.	June 10

As a deduction from this year's result with potatoes, the following conclusions we think are correct:

1st. That of the vast number of varieties now on the market, the only way to determine the best for a certain soil and climate is by actual test. The potatoes described under varieties seem to be the best here.

2nd. That a combination of two parts cotton seed meal, one of acid phosphate and one of kainite seems to be a good commercial fertilizer for potatoes.

3rd. While these results of themselves do not guarantee it, yet, when taken in connection with results of other stations, it seems that large potatoes planted whole give the best results.

STRAWBERRIES.

Last fall the strawberries were all transferred to a new bed, in the hopes of getting rid of cocoa. This was only partially successful, but this spring a very fair test crop of fruit was obtained.

The following table gives names of varieties, with approximate time of ripening and length of fruiting.

NAME.	When Ripe	Ceased bearing	Per cent. living Sept. 1.
Gold	April 2	April 15	80
Pioneer	March 25	May 15	75
Mammoth	April 6	April 20	80
Chas. Downing	April 2	May 15	85
Hampden	April 20	May 10	80
Mt. Vernon	April 20	May 10	75
Summit	April 25	May 10	20
Bubach	April 10	May 12	100
Jas. Vick	April 14	May 5	75
Sharpless	April 2	May 20	70
Crescent Seedling	March 25	May 5	100
Itasca	April 15	May 1	75
Manchester	April 10	May 15	80
Jucunda	April 15	May 10	65
Parry	Aprll 10	May 20	35
Cohazuic	April 5	May 5	20
Candia	April 20	May 11	70

NAME.	When Ripe.	Creased bearing.	Per cent living. Sept. 1
Indiana	April 5	May 20	100
Triumph De Gand	April 1	May 10	35
Cumberland	April 10	May 20	80
Crimson Cluster	April 5	May 30	45
Norman	April 5	May 30	85
Cornelia	April 10	May 15	80
Ontario	April 1	May 15	50
Coville	April 10	May 15	85
Henderson	April 10	May 20	35
Kentucky	April 11	May 30	100
Ohio	April 11	May 30	100
Lida	April 2	May 1	40
Mammoth	April 1	May 5	55
Jessie	April 11	May 5	100
Haverland	April 11	May 20	85
Photo	April 11	May 5	75
Monmouth	April 1	May 5	85
Gandy	April 11	May 20	85
Farnsworth	April 1	May 10	65
Enhance	April 10	May 10	100
Excelsior	April 15	May 25	100
May King	April 1	May 20	95
Belmont	April 15	May 30	100
Haverland's Seedling.	April 10	May 25	75
Great American	April 10	May 30	65
Warfield's No. 2	April 5	May 5	75
Wilson	April 11	May 5	85
Bidwell	April 15	May 15	85
Capt. Jack.	April 11	May 5	65
Jewell	April 12	May 10	20

REMARKS.

Since the fruiting season these plants have been put to quite a severe test as to their ability to stand this climate. From the latter part of April until about same date in June they were subjected to a severe drought. From that time up to this, Sept. 1, there has been a very heavy rainfall, accompanied by warm weather.

The following is a description of the best varieties :

Pioneer—This we consider one of the best. It is a large leafed berry, growing very large. Leaves dark green. Its fruiting season is as long as any other and it is constantly loaded with large conical

berries of fine flavor. The fruit stems being long and growing erect, the fruit is thus kept well off the ground.

CHAS. DOWNING—An excellent berry. Foliage resembling preceding, but not so heavy or so dark. Fruit somewhat smaller and not as abundant as Pioneer, but of excellent flavor.

SHARPLESS—This gave promise in the early season of the largest bearer, being crowded with green fruit. Just before reaching maturity, however, large quantities of fruit dropped off. What did mature was rather small. Neither has it stood the summer as well as some others.

CRESCENT SEEDLING—The earliest berry of the lot. It is of only moderate size, and a rather poor bearer, but its earliness serves to make up for this. It is of excellent flavor.

PARRY—A splendid berry. Fruit very large and excellent flavor, long, conical, bright, red berry. A very good bearer, but has not stood summer well.

TRIUMPH DE GAND—A very fine, large berry, but open to the same objections as above.

ONTARIO----Good bearer, of large but very irregular fruit.

OHIO----Vigorous grower. Bears a good crop late into the season. Fruit large, roundish, bright and red, of uniform size and shape, but most too sour to be called good.

LIDA----Rather week vines, but an abundant bearer of long, conical, cherry-red berries. Stands summer poorly.

PHOTO----Vines vigorous. Bears a good crop of round berries.

GONDY----A good grower and healthy. Fruit of good size, bright color and fine form. Only moderately productive.

MAY KING----Only a little later than Crescent. A moderate bearer. Fruit a beautiful shape and of a light, red color. A fine berry.

While these are the best, yet all are good, and space alone prevents our giving a full description of all.

RASPBERRIES.

The following varieties of this fruit were grown on the station this year:

Thompson's Early Prolific, Thompson's Early Pride, Shaffer, Souhegen, Gregg.

Of these Thompson's Early Pride, Souhegen and Gregg fruited this spring. The two former were very inferior, both in quantity and quality of fruit, while the latter was pronounced to be excellent. The fruit was not only large but very abundant.

One variety of blackberries, Wilson's Early, also did exeellently.

ORCHARD.

The following, although only one year in the orchard, fruited this year:

PEACHES.

ALEXANDER----Matured two large, juicy peaches of fine flavor and bright, red color. Fruit ripe June 15.

BEATRICE----Matured three peaches about the same as above. Fruit similar to Alexander, but not quite so large.

GENERAL LEE:---A very nice peach. Quite large and juicy, but wormy. Ripe July 18.

CHINESE CLING----Very large. white juicy peach. Ripe July 18.

PLUMS.

PRUNUS PISSARDI----This beautiful tree has grown wonderfully and matured some little fruit by June 5. While of not much value for eating, the fruit is said to be excellent for cooking.

WILD GOOSE----A moderate crop of large, oval, bright, red plums of excellent flavor. Matured June 12.

BOTAN'S JAPAN----This tree bore a tremendous crop of its excellent fruit. The fruit is about the size of a guinea egg of a dark, red color, small seeded and fleshy, of flavor somewhat a cross between apricot and peach.

KELSEY'S JAPAN----The tree could hardly support this crop. The fruit, however, about the size and shape of a large hen egg, was rendered worthless by the curculio. It is a little later than Botan.

ROBINSON----This is an excellent little plum. While the

fruit was not large, it was quite abundant, and commenced ripening latter part of May and continued until July.

NEWMAN'S----A good plum, and larger than Robinson, but not so prolific.

SMALL GRAIN.

Below we give a table showing treatment of soil for and yield of oats planted in Nov. 1888; each experiment covered one acre.

No. of plat	Previous treatment of soil	How fertilized	yield sheat oats lbs	per cent grain	Bushel grain
1	In encilage corn, summer of 1888, fertilized with 150 lbs cotton seed meal. 150 lbs acid phosphate.	300 lbs cotton seed meal, 150 lbs acid phosphate.	4306	*	*
2	Ensilage corn 1888, unfertilized.	Nothing.	8050	26.6	73.9
3	Peas in 1888, peas turned under,	300 lbs cotton seed meal, 150 lbs acid phosphate.	7060	26.8	59.1
4	Peas in 1888, peas turned under.	Nothing	7315	29.2	66.7
5	Peas in 1888, peas saved for hay.	Nothing	8468	28.6	78.3

*Sample lost in burning of barn.

The effects of drainage were never more plainly illustrated than in the above results. No. 1 was lost in barn, but judging from the light tonnage obtained, it is safe to say that its yield of grain would have fallen far below the others. No. 1 was treated exactly similar to No. 2, and in addition had a heavy fertilizer. No. 2 was on a gentle incline, however, and hence, was much better drained than its neighbor on top of the hill.

This was again the case with plats 3 and 4, while plat No. 5, although robbed of its peas, gave the largest yield of any, and from its position was the best drained.

Two other varieties of oats, White Russian and Centennial, were also planted. Of these, the Centennial rusted so badly that it was not worth harvesting. The White Russian gave per acre in straw 926.1, pounds, grain 18.3 bushels. It also was badly rusted.

Two varieties of barley i. e.: Hulless and Champion two rowed, had been harvested and stored in barn for future trash-

ing, but met with the same fate as that building. They both promised well, particularly the latter. The former was not so good, having suffered from rust.

The wheats all suffered more orless from the pest, some almost to the extent of total failure. The following are the results with time of harvest:

NAME	Wheats Yield per acre Straw lbs	Grain bushel	Harvested	Remarks
Michigan Bronze	8820	19.9	May 15	Rusted
Saskatchawan	3394	12.6	May 11	Badly rusted
Martin's Amber	3528	3.4	May 10	Badly rusted
White Clawson	3740	....	....	Failed utterly
Saskatchawan	4410	2.2	May 28	Rusted badly

It is quite plain from the last two years result that only rust proof varieties of small grain will succeed in this climate.

GRASSES.

On November 2, 1888, the following grasses and clovers were sown on well prepared land:

Crimson clover, White clover, Red clover, Bakhara clover, Alsike clover, Alfalfa, Timothy, Red Top, Kentucky blue grass, Randal, Soft Brome, Rescue, Perennial Rye, Italian Rye, Tall Fescue, Tall Oat.

Of these the Bakara clover, Alfalfa and Kentucky Blue were a failure. A later planting of the later, however, after a long struggle, is now doing as well as could be desired. Although we made several sowings of Rescue, not a seed could be induced to germinate. The Crimson, Reed and Alsyke clovers did splendidly, the two latter giving two good cuttings before succumbing to the combined enemies, sun and native grasses. While the grasses, with the few exceptions above, all did well; the two ryes Italian and English surpassed them all. They were sown in November, and by January 15 the former was two feet high, and would have given a fine cutting. The latter, while from its nature, not growing so high, yet at that

time would have afforded as fine a pasture as the dairyman or stock-raiser could wish.

VEGETABLES.

Early in February the half acre garden of this station was thorou hly prepared for vegetables. A heavy dressing of a compost composed of equal parts of cotton seed and stable manure was spread equally over the whole garden. This was then turned under with a two-horse plow. Subsequent cross plowings and harrowings incorporated the fertilizer thoroughly with the soil. Seeds used were obtained from Richard Frotscher, of New Orleans. Owing to the severe spring drought, lasting for eight weeks, the whole planting, consisting of five varieties of lettuce, five of radish, eight of beets, fourteen of onions, six of peas, ten of beans, three of okra and three of sugar corn, was almost a total failure. So much was this the case that we do not feel warranted in passing an opinion upon the merits of any. The only exception to this rule is the okra. Of the three varieties planted, i. e.: Tall Growing, Dwarf White and New Velvet, the latter did much the best. Not only is it more tender than the others, but is also much more prolific. It is a dwarf variety, round, smooth pods, free from ridges and seams, and not prickly to the touch.

LIVE STOCK.

This consists of a trio of Jersey and of Holstein cattle, together with twelve breeds of poultry. There is scarcely anything to add concerning the Holstein to what has already been published.

Since writing the above, the Holstein cow dropped a bull calf. Unfortunately the calf was dead. After some little trouble, during which invaluable services were rendered by Dr. W. H. Dalrymple, veterinary surgeon of the station the cow is now doing excellently. She now gives from five and a half to six gallons of milk per day. This milk is of far better quality than with her former calf. Butter tests are now in progress and will be given to the public as soon as possible.

On February 27, the Jersey cow dropped a beauti-

ful heifer calf. As soon as the milk become fit for use it was carefully weighed after each milking and every drop devoted to butter-making. A small Blanchard churn is used. From then up to the present date, Oct. 21, this cow has given in all 3368 pounds of milk. From this there has been obtained 179 pounds butter, or an average of one pound of butter to 18.8 pounds of milk. This at an average cost of twelve cents a day.

POULTRY.

On February 27, eight poultry yards were stocked.

The following table gives the number of eggs laid by each hen from April 15 up to July 15 :

NAME OF BREED.	No. hens in pen	Total No. of eggs	Average eggs per day & hen
White Crested Black Polish*	2	37	.4
Brown Leghorn	1	38	.4
Light Brahma	1	45	.5
Buff Cochin	2	41	.4
White Wyandott	1	31	.34
Laced Wyandott	1	9	.1
Barred Plymoth Rock	1	20	.22
White Plymoth Rock	1	2	.02
Langshan*	1	7	‡.07
Black Minorca	1	24	.26
White Minorca	1	51	.56

*One hen was sick and scarcely laid during whole time. ‡Hen died after second month.

COTTON.

Owing to the destruction of this crop by storm last year and the consequent loss of results all experiments, in fertiltzing were duplicated this season.

Dame Nature, in a mood of pity for the poor cotton farmer, curbed the rainy god early in February, and for most of the

year resisted not only his prayers but also the supplications of many an unhappy sugar planter, and only for a brief period in July was there too much rain. Then, confining Boreas with double bars within his ocean cave, stationed herself at the different gins of this community and welcomed the happy farmer. The season in this locality has been exceptionally fine, as one could readily see by comparing the following tables of yields with like ones published last year.

These experiments occupied the same plats as their duplicates of last year, and the seed, "Brannon," was also the same.

PLAT 12—COTTON—NITROGENEOUS FERTILIZERS.

Question asked: Does this soil need nitrogen? How much and in what form?

FERTILIZATION AND YIELD PER ACRE.

No. of Exp.	How Fertilized	Cotton Seed	Lint.
1	Mixed Minerals,* 79.8 lbs Nitrate Soda	2912	970.6
2	Mixed Minerals, 159.6 lbs Nitrate Soda	3276	1092.0
3	Mixed Minerals, 53.2 lbs Sulphate Ammonia	3234	1078.0
4	Mixed Minerals, 106.4 lbs Sulphate Ammonia	3066	1022.0
5	Mixed Minerals	3168	1056.0
6	Nothing	2296	798.6
7	Mixed Minerals, 112 lbs Dried Blood	3168	1056.0
8	Mixed Minerals, 224 lbs Dried Blood	2758	919.3
9	Mixed Minerals, 140 lbs Fish Scrap	2982	994.0
10	Mixed Minerals, 280 lbs Fish Scraps	3024	1008.0
11	Mixed Minerals	3010	1003.3
12	Nothing	2436	812.0
13	Mixed Minerals, 168 lbs Cotton Seed Meal	2884	961.3
14	Mixed Minerals, 336 lbs Cotton Seed Meal	2800	933.3
15	Mixed Minerals, 504 Cotton Seed	2688	896.0
16	Mixed Minerals, 1008 lbs Cotton Seed	2884	894.6
17	Nixed Minerals	2912	970 6
18	Nothing	1744	581.3

*Mixed Minerals: 280 lbs Acid Phosphoric, 347.2 Kainite.

PLAT 13—COTTON. PHOSPHATIC FERTILIZER.

Questions asked: "Does this soil need Phosphoric Acid? If so how much and in what form?"

FERTILIZATION AND YIELD PER ACRE.

No. of Exp.	How Fertilized.	Cotton Seed	Lint	Remarks.
		lbs.	lbs.	
1	Basal Mixture,* 280 lbs Dissolved Bone........	2684	894.6	
2	Basal Mixture, 560 lbs Dissolved Bone.........	2828	942.6	
3	Basal Mixture, 280 lbs Acid Phosphate.........	3010	1003.3	
4	Basal Mixture, 560 lbs Acid Phosphate.........	2338	779.3	
5	Basal Mixture.	2660	886.6	
6	Nothing....................................	2072	690.6	
7	Basal Mixture, 280 lbs Reverted Dissolved Bone	2712	904.0	
8	Basal Mixture, 560 lbs " " "	2296	765.3	Dis. Bone
9	Basal Mixture, 280 lbs " Acid Phosphate	2520	840.0	received too
10	Basal Mixture, 560 lbs " " "	2464	821.3	late to apply
11	Basal Mixture..............................	2212	770.6	
12	Nothing....................................	1890	630.0	
13	Basal Mixture, 280 lbs Bone Meal..............	2352	784.0	
14	Basal Mixture, 560 lbs Bone Meal..............	2268	756.0	
15	Basal Mixture, 140 lbs Gypsum.................	2702	900.6	
16	Basal Mixture, 280 lbs Gypsum.................	2578	892.6	
17	Basal Mixture..............................	2254	751.3	
18	Nothing....................................	1696	565.0	

*Basal Mixture: 280 lbs Cotton Seed Meal, 347 Kainite.

Plat 14—Cotton. Potassic Fertilizers.

Question: "Does this soil need Potash? How much and in what form?"

FERTILIZATION AND YIELD PER ACRE.

No. of Exp.	How Fertilized	Cotton Seed	Lint	Remarks
		lbs	lbs.	
1	Meal Phosphate,* 168 lbs Kainite..............	2702	900.6	
2	Meal Phosphate, 336 lbs Kainite...............	2226	742.0	
3	Meal Phosphate, 42 lbs Muriate Potash........	2870	990.0	
4	Meal Phosphate, 84 lbs Muriate Potash........	2660	886.6	
5	Meal Phosphate............................	2072	690.6	
6	Nothing....................................	2072	690.6	
7	Meal Phosphate, 42 lbs Sulphate Potash........	2296	798.6	
8	Meal Phosph., 84 lbs Sulphate Potash..........	2548	849.3	
9	196 lbs C. S. Meal, 280 lbs Acid Phosphate, 49 lbs Nitrate Potash......................	2632	877.3	
10	84 lbs C. S. Meal, 280 lbs of Acid Phosphate, 98 lbs of Nitrate Potash....................	2870	956.6	
11	Meal Phosphate............................	2170	723.3	
12	Nothing....................................	1562	520.3	

*Meal Phosphate: 280 lbs Cotton Seed Meal, 280 lbs Acid Phosphate.

The questions asked were:

First. "What element or elements of plant food does this soil need?"

Second. "In what forms and quantities is this deficiency best supplied?"

Nature is niggardly with her secrets, and in this instance, despite our efforts to rend them from her, has only partially yielded. Indeed, in most of these experiments, so small is the increase of the fertilized over the "nothing" plats, that it becomes exceedingly difficult to draw any reliable conclusions.

Nitrogen seems to yield the best return, for in plat 12-experiment No. 2, we have the large yield of 3276 pounds, an increase of 246 pounds over the average of 5, 11 and 17, where no nitrogen was supplied, and over a thousand pounds increase over the average of the three "nothing" experiments. In experiments. No. 3, the increase is scarcely less marked, while in No. 4, where double the quantity of sulphate of ammonia is used, there is actually a smaller yield than where no nitrogen is supplied. This also must be due to foreign causes. Now turning to plat 13 we find here an increase, seemingly due to the use of phosphoric acid. Experiment No. 3 gives the largest yield, but all the yields, are so close that positive conclusions are almost impossible. It will be noticed that experiments 1 to 6 and 9 to 12 are duplicates, the only difference being that in the latter the phosphoric acid is in the "reverted," while in the former it is in the soluble form, These results would seem to contradict those of last year i. e., that reverted phosphoric acid is of very little benefit; but when we bear in mind that it was on this same land that these experiments were conducted, we readily account for this seeming contradiction. The acids of the earth have evidently acted upon the reverted of last year, rendering it soluble, and hence the plants were benefitted by the application made last year, and which was a total loss to last year's crop. In plat 14 there seems to be almost an unmistakable indication of benefit from potash. As this is the first time in this station's experience that this has appeared, we hesitate, however, to admit this without more extended research.

In the above conclusions it is well to remember that the differences from which they are drawn are very slight such as might

be due to entirely foreign causes, some of which are slight differences in stand, small differences in the fertility of the soil itself, etc. With such small differences it will require years of patient toil before any positive conclusions can be drawn.

CORN.

The following is a tabulated statement of yield of varieties of this crop.

Yield of varieties of corn per acre. Object of experiment. To determine variety best suited to this soil and climate.

Name of Variety.	Total lbs	per cent. cob	per cent. shuck	per cent. grain	bushel grain
Patterson	1419	12.4	11.29	76.31	19.3
Mosby	2277	5.18	13.79	81.03	32.7
Blount	2475	12.5	9.44	78.6	34.0
Alabama	2178	11.11	7.52	81.37	31.6
McQuade	1287	15.03	8.62	76.35	20.9
White Normandy	1782	....	....	....	....
White Mexican	2838	6.12	7.22	86.66	43.8
Prolific	3300	15.62	9.37	75.01	44.2
New Madrid	2194	14.92	8.95	76.13	29.5
Red Cob Gourd Seed	3118	13.75	6.02	80 23	44.6
Champion	1072	12.24	8.12	79.64	15.3
New Hickory King	2046	9.43	13.2	77.37	28.2
Mexican Flint	2706	16.07	12.5	72.43	29.8
Western Yellow	2310	14.0	10.0	76.00	23.7
Mexican and Creole, mixed	1765	12.12	12.12	75.76	23.8
Yellow Flint	2607	15,28	10.76	73.96	34.4
Yellow Golden	2013	20.00	16.36	63.64	22.9
Mixture of Red Cob and Mosby	2953	12.5	14 6	73.91	38.9

The severe drought beginning in the early part of April and not ending until well into July, injured this crop very severely. The Prolific goes far ahead, thus showing its ability to stand drought better than the others. Next to it comes Red Cob Gourd Seed. While Blount the best of last year, falls to sixth in yield.

FERTILIZER EXPERIMENT.

The same questioh with corn as wtth cotton were put.

Below are the results :

PLAT IX—POTASH.

VARIETIES USED—BLUONT.

Object of experiment to determine 1st. If this soil needs potash. 2nd. If so. in what form and quantity.

No of Exp't	How Fertilized	Yield Per Acre	
		Shuck corn lbs	Grain Bushel
1	Meal Phosphate*, 168 lbs. Kainite	2828	41.5
2	Meal Phosphate, 336 lbs Kainite	3696	51.8
3	Meal Phosphate	3472	48.7
4	Meal Phosphate, 42 lbs. Muriate Potash	3752	52 5
5	Meal Phosphate, 84 lbs. Muriate Potash	3584	50.3
6	Meal Phosphate	3142	38.4
7	Nothing	3198	44.1
8	Meal Phosphate, 42 lbs. Sulphate Potash	3198	44.1
9	Meal Phosphate, 84 lbs. Sulphate Potash	3396	51.9
10	Meal Phosphate	3752	52.5
11	280 Acid Phosphate 196 lbs. Cotton Seed Meal, 49 lbs. Nitrate Potash	3696	51.8
12	280 lbs. Acid Phosphate, 84 lbs. Cotton Seed Meal, 98 lbs. Nitrate Potash	3416	48.0

*Meal Phosphate—280 lbs. Cotton Seed Meal.
280 lbs. Acid Phosphate.

PHOSPHORIC ACID--PLAT NO. X.

VARIETY—RED COB GOURD SEED.

Object to determine 1st, If this soil need phosphoric acid, and in what form and quantity.

No. of Exp't.	How Fortilized	Yield per acre	
		Shuck corn lbs	Grain Bushel
1	Basal Mixture*, 280 lbs. Dissolved Bone	2968	42.5
2	Basal Mixture, 560 lbs. Dissolved Rone	3248	46.5
3	Basal Mixture	3528	50.5
4	Basal Mixture, 280 lbs. Acid Phosphate	2996	42.9
5	Besal Mixture, 5€0 lbs. Acid Phosphate	3472	49.8
6	Basal Mixture	3472	49.8
7	Nothing	3528	50.5
8	Basal Mixture, 280 lbs. Bone Meal	4032	57.7
9	Basal Mixture, 560 lbs. Bone Meal	3732	53.4
10	Basal Mixtnre	3584	51.1
11	Basal Mixture, 140 lbs. Gypsum	3752	53.7
12	Basal Mixture, 280 lbs. Gypsum	3248	46.5

*Basal Mixture—280 lbs. Cotton Seed Meal.
347.2 lbs. Kainite.

PLAT XI—NITROGEN.

VARIETY—RED COB GOURD SEED.

Object to determine 1st. If this soil needs nitrogen. 2nd. If so, in what form and quantity.

No. of Exp't	Fertilizer Used	Yield Per Acse	
		Shuck corn lbs	Grain Bushel
1	Mixed Minerals*, 79.8 lbs. Nitrate Soda..................	2520	36.1
2	Mixed Minerals, 158.6 lbs. Nitrate Soda..................	3640	52.1
3	Mixed Minerals, 53.2 lbs. Sulphate Ammonia............	3248	46.5
4	Mixed Minerals, 106.4 lbs. Sulphate Ammonia...........	3192	45.5
5	Mixed Minerals, 112 lbs. Dried Blood....................	3304	47.3
6	Mixed Minerals, 224 lbs. Dried Blood....................	3360	48.1
7	Mixed Minerals, 140 lbs. Fish Scrap......................	2800	50.1
8	Mixed Minerals, 280 lbs. Fish Scrap......................	4136	59.2
9	Mixed Minerals, 168 lbs. Cotton Seed Meal..............	2632	37.5
10	Mixed Minerals, 336 lbs. Cotton Seed Meal..............	2968	42.5
11	Mixed Minerals, 504 lbs. Cotton Seed....................	2632	37.6
12	Mixed Minerals, 1008 lbs. Cotton Seed..................	2856	40.9

*Mixed Minerals—280 lbs. Acid Phosphate.
347.2 lbs. Kainite.

All of this corn was planted March 14th and 15th three kernels being dropped at distances of exactly two feet. A light shower immediately after planting, caused it to greminate immediately, and when thinned a perfect stand, consisting of one stalk to every two feet, was left. From this time until late in July not one drop of rain fell. Notwithstanding this the whole crop grew beautifully, and did not show the least sign of suffering, until the time of tasseling—thanks to the thorough cultivation which it had received. But even cultivation could not supply the increased demand for moisture incident upon this process, and for about ten days the whole crop, and particularly the fertilized experiments suffered severely.

During growth the effect of the fertilizers were very apparent, particularly where phosphatic fertilizers were used. In Plats 10, Experiment 1, 2, 4 and 5 immediately took the lead, and were twice as large as either 3 or 6, the Basal Mixture, and fully two-thirds as tall, and of a much better color than 7. But it is the same old story of the Turtle and the Hare. Pushed forward by the abundance of plant food, the fertilized corn reached the tasseling stage much earlier, and hence suffered much longer. The unfertilized corn grew much slower, and hence suffered only a short while. When rain did come, the fertilized corn was injured too much to recover what it had lost, and hence the "Nothing" experiments actually, in several instances, exceed its neighbors in yield.

From such an array of figures so similar, it is impossible to draw any conclusions. Judging from the appearance, during growth of crops, we would say that Phosphoric Acid is highly beneficial.

SUGAR CANE.

From stubble of last year's plant an excellent crop of this plant was raised. The following is the report of analysis published some time since in the Louisiana Planter, made by Prof. B. B. Ross, Chemist of the Station and Professor of Chemistry in the La. State University and A. and M. College. The first analyses were made Nov. 25th, the others about the First of the asme month. Samples of cane were taken from each experimental plat, and were analyzed in the laboratory of the University by the members of the senior class in chemistry, consisting of Cadets Batchelor, Bynum, Furman, Guilbeau, McVea, Overton, Roy, Stubbs and Young. The following are the results :

No. of Experiment	How Fertilized, per Acre	Density, deg. Beaume	Total Solids	Sucrose	Glucose	Solids not Sugars	Co-efficient of Purity	Glucose Ratio
1	500 lbs Cotton Seed Meal......................	9.5	17.2	14.6	1.54	1.06	84.88	10.55
2	500 lbs Acid Phosphate......................	9.6	17.3	14.4	1.42	1.78	83.23	9.86
3	500 lbs Kainite..............................	10.0	18.1	16.4	1.00	0.70	90.61	6.09
4	Nothing......................................	10.1	18.2	15.2	1.12	1.88	83.51	7.37
5	500 lbs Cotton Seed Meal, 500 lbs Kainite...	9.4	17.0	14.2	1.86	0.94	83.53	13.10
6	500 lbs Cotton Seed Meal, 500 lbs Acid Phos..	10.3	18.6	16.8	1.28	0.52	90.32	7.62
7	500 lbs Cotton Seed Meal, 500 lbs Acid Phosphate, 500 lbs Kainite	10.0	18.0	15.6	1.08	1.32	86.67	6.92
1	Samples of cane from the same plats were analyzed from three to four weeks previously with results as follows:	9.4	17.0	13.8	2.16		81.18	15.65
2		9.0	16.3	13.1	2.45		80.37	18.70
3		9.5	17.1	13.6	2.26		79.53	16.62
4		9.5	17.2	13.7	2.57		79.65	18.76
5		9.3	16.8	13.2	2.45		78.57	18.56
6		8.9	16.0	12.0	2.98		75.00	24.84
7		10.0	18.0	14.0	3.17		77.77	22.63

It will be seen that there has been quite a marked increase in the purity co-efficient, while the great falling off in the glocuse ratio is even more apparent.

As far as the analyses indicate, conclusions are difficult, if not impossible to draw. It is much to be regretted that the

yields of these respective experiments are not at present available. It was intended to take this cane to the Sugar Station to be worked up by diffusion, but that being delayed longer than was expected, it was necessary to windrow the whole to keep from loosing it. The high sugar content, a characteristic of all upland cane that we have examined, is remarkable. Can there be any doubt that cane, when it can be raised at so much less cost and contains such a large per cent. of sugar, will pay handsomely on these uplands. The following, one of the best analyses of lowland cane, of a plantation not far distant, is inserted for comparison.

Beaume	8.3
Total solids	15.
Sucrose	13.1
Glucose	1.52
Solids not sugar	.38
Glucose ratio	11.60
Coefficient purity	87.33

There is one point in the comparison of these two sets of analyses which is well to notice, and which may account, in a measure, for the very general report that it is more difficult to make sugar from upland than from lowland cane. While the sucrose of the highland cane is much in excess of the lowland, yet the quantity of solids not sugar is larger in the former than in the latter.

SORGHUM.

Besides the cane above mentioned, there was planted one-half acre each of Lynks' Hybrid and of Early Orange Sorghum. This was cut and sent to the Sugar Experiment Station, where it was worked up by the diffusion process, giving 120 pounds of brown sugar to the ton of sorghum.

The following are the analyses of thirty-five varieties of this plant grown on this station from seed received from the U. S. Department of Agriculture :

Number	Name	Density, Deg. Beaume.	Total Solids	Sucrose	Glucose
1	Swain's Early Golden	10.5	18.9	15.2	2.27
2	New Orange	10.3	18.7	14.4	2.33
3	No. 14 Unknown	9.0	16.2	10.5	5.00
4	Planters' Friend, from Australia	9.2	16.7	12.0	3.12
5	Early Amber	9.8	17.7	14.5	1.85
6	No. 39, from South Africa	10.9	19.7	15.6	1.28
7	Late Orange	10.5	18.9	13.0	4.54
8	Honduras	6.4	11.6	4.1	6.25
9	White African	10.5	18.9	13.5	4.12
10	Improved Orange	11.3	20.5	14.6	4.16
11	New Orange	12.2	26.2	15.1	3.33
12	White India	9.5	17.2	15.1	1.66
13	Honey Dew	9.6	17.4	13.0	2.33
14	Unknown	10.2	18.5	12.3	5.00
15	Red Liberian	10.2	18.5	12.3	5.00
16	No. 53. from South Africa	10.3	18.7	10.5	5.55
17	Folger's Early	10.1	18 2	13.1	2.94
18	No. 61, New variety from East India	9.2	16.7	10.6	4.55
19	New Sugar Cane	6.2	11.2	5.2	3.32
20	Wanbansee	7.0	12.7	8.2	3.16
21	Whiting's Early	6.7	12.1	8.4	2.50
22	Goose Neck	7.6	13.7	8.2	4.16
23	Early Tennessee	6.4	11.6	5.7	3.06
24	New, from Georgia	7.7	13.9	9.7	2.77
25	Sorghum, Sacharatum, from Cape Town Africa	5.9	10.7	4.9	5.01
26	Dutchers Hybrid	5.9	10.7	6.0	4.38
27	New Indian variety	8.5	15.4	8.1	6.25
28	No. 57	8.1	14.7	7.8	3.37
29	No. 26, from East India	6.9	12.5	6.3	3.84
30	Chinese	7.2	12.9	7.6	4.16
31	Prices New Hybrid	6.8	12.2	7.0	3.33
32	No. 36, from South Africa	8.5	15.4	4.4	5.03
33	No. 46	9.0	16.3	11.4	2.68
34	Link's Hybrid	8.7	15.7	11.1	3.43
35	No. 51	7.6	13.7	7.8	5.12

Attention is called to the high sugar content of some of these varieties, four of which, i. e., White India, New Orange, No. 39, and Swain's Early Golden, exceed 15 per cent.

VARIETIES OF COTTON.

Ever since the establishment of the Experiments Station in this State, it has been one of their departments of work to test different varieties of cotton. In selecting cotton seed there are three things that we should ever keep in mind :

First—The variety chosen should give a good gross yield of seed cotton.

Second—This cotton, when taken to the gin, should yield the largest per cent. of lint possible.

Third—That lint, when put upon the market, should be of sufficient length of staple to command the highest market price. These are the three great requisites of a perfect cotton—three requirements seldom found hand in hand,

From results of varieties grown on this Station last year we have compiled the following table: showing, first, yield of seed cotton per acre; second, per cent. of lint; third, per cent. of seed; fourth, yield of lint per acre. These experiments were carefully made on a small Gullet gin.

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YIELDS OF VARIETIES OF COTTON.

Name	Lbs Seed Cotton Per Acre	Per Cent. Seed	Per Cent. Lint	Total Lint Per Acre	Class	Value Per Lbs	Value of Lint Per Acre	Remarks
Mikado...........	2014	68.8	29.2	588	Good Middling	$9\frac{1}{8}$	$59.06	Classed with "Allen" staple 1 ct. over same grade common cotton.
Jeff Welbon's Pet.	2544	67.7	31.2	793	Middling.......	$9\frac{5}{8}$	76.32	
Ea-t...	1539	70.3	28.6	440	Middling.......	$10\frac{5}{8}$	46.75	
Dearings Small Seed	2831	64.4	30.4	860	Strict Middling	$9\frac{3}{4}$	83.85	
Jower's Improved	3078	70.0	28.8	886	*" "	10	88.60	2 yrs. seed, "Benders" staple. $\frac{1}{2}$ ct. over same grade common cotton
Herlong...........	2964	61.5	26.9	797	Strict Middling	$9\frac{3}{4}$	77.70	2 year's seed.
King's Improved..	2603	67.0	30.6	796	" "	$9\frac{1}{8}$	77.79	"
Jones' Improved..	2432	67.9	28.8	700	Good Middling.	$9\frac{7}{8}$	69.12	"
BancroftsExHerlg	2375	69.6	29.4	698	Middling.......	$9\frac{5}{8}$	67.18	"
Martin's Prolific..	2812	60.9	37.7	1060	"	$9\frac{5}{8}$	102.02	"
Little Brannon...	2451	64.1	33.3	817	"	$9\frac{5}{8}$	78.63	"
Peterkin..........	2223	66.6	31.6	702	Strict Middling	$9\frac{3}{4}$	68.44	"
Jower's Improved	2094	69.0	29.0	607	" "	$9\frac{3}{4}$	59.17	"
CherryLongStaple	1520	68.7	30.0	456	Middling.......	$9\frac{5}{8}$	43.89	3 year's seed.
Peeler.............	1976	67.2	29.8	588	"	$9\frac{5}{8}$	56.59	2 year's seed.
Bancroft's Herlong	2033	71.0	27.1	550	"	$9\frac{5}{8}$	52.94	"
Hawkins..........	1767	67.7	30.1	531	Strict Middling	$9\frac{3}{4}$	51.76	"
Dicksons..........	1938	66.6	31.3	606	" "	$9\frac{3}{4}$	59.08	"
Peerless	1577	67.4	31.0	488	Good Middling.	$9\frac{7}{8}$	48.19	"
Welborn's Pet....	2223	70.0	29.0	644	Middling........	$9\frac{5}{8}$	61.98	"
CherryLongStaple	2211	68.6	30.2	667	Strict Middling	$9\frac{3}{4}$	65.02	3 year's years.
Taylor's Improved	2204	69.8	29.3	645	Middling	$9\frac{5}{8}$	62.08	"
S. B. Maxey......	1900	67.0	32.0	598	Strict Middling	10	59.80	2 year's seed "Bender" staple $\frac{1}{4}$ cent over same grade common cotton
Peterkin..........	1596	66.6	31.1	496	" "			3 year's seed.
Allen'sLongStaple	1083	69.0	29.9	323				
Oats..............	1330	68.5	28.5	379	Strict Middling	$9\frac{3}{4}$	36.95	2 year's seed.
Cherry's Cluster..	1178	70.4	27.4	322	" "	$9\frac{3}{4}$	31.34	"
Tennessee Silk....	1463				Good Middling.	$9\frac{7}{8}$		"
S. B. Maxey......	1482	70.9	28.6	423	Strict Middling.	$9\frac{3}{4}$	41.24	"
Allen'sLongStaple	$1472\frac{1}{2}$	67.5	28.5	419	" "	10	41.90	3 year's seed "bender's" staple $\frac{1}{4}$ cent over same grade common cotton
Shine's Early.....	1154	67.2	31.1	358	Good Middling.	$9\frac{7}{8}$	35.34	3 year's seed.
Tennessee Silk...	1007	67.1	26.4	265	Strict Middling	$9\frac{3}{4}$	25.83	"
Crawford.........	1216	68.7	28.1	341	Middling.......	$9\frac{3}{8}$	32.82	"
Southern Hope....	1430	71.4	28.0	400	Strict Middling	$10\frac{1}{4}$	50.00	2 years Extra staple, $\frac{1}{2}$ cents over same grade of common cotton
Boyd's Prolific....	1449	70.4	27.7	401	Strict Middling	$9\frac{3}{4}$	39.09	3 year's seed.
Petit Gulf........	1084	69.6	25.0	272	Good Miduling.	$9\frac{7}{8}$	26.86	2 year's seed.
Zellners..........	1008	69.6	26.1	263	Strict Middling	$9\frac{3}{4}$	25.63	"
Griffin Improved..	686				Middling	$9\frac{5}{8}$		

In order to ascertain how each variety answered the third requirement, a sample of each was sent to New Orleans and there classed according to the length of staple alone. While the majority of them were very similar, yet the difference in some few is very great. One comparison is sufficient. The variety yielding the largest amount of seed cotton is Jower's Improved, 3078 pounds. This is the first time that Jower's has done so well with us, and hence these figures are not conclusive. They serve our purpose, however. Next to it comes Herlong, with 2964, and next Dearing's Small Seed, 2840. From these there is quite a variation, some running as low as 1000 pounds. The Jower's Improved gave 28.8 per cent. of lint worth ten cents a pound, and hence the product of one acre was worth $88.60. Herlong, 26.9 per cent. lint at nine and three-quarter cents, giving a gross income of $77.70. While the Dearing's Small Seed, though third in gross yield, yet gave 30.4 per cent. lint, which at nine and three-quarter cents per pound brought an income of $83.85 per acre. If now the excellent points of these two varieties, the large seed cotton yield of Jower's Improved, with its extra price of ten cents per pound, and the larger per cent. of lint of the small seed, could be combined, we would have an excellent cotton. There are four distinct varieties of gossypium known to the botanist, 1st G. Indicum or Herbaceum. 2nd G. Arboreum : 3d G. Barbadense ; and 4th G. Peruvianum. This is Lowden's classification. Later authorities give only two, i. e., G. Herbaceum and G. Barbadense," and claim that the "Indicum" and "Arboreum" are species of "Herbaceum" the others of "Barbadense." The principal ones of these with which we have to deal are "G. Herbaceum," the common upland cotton, and "G. Barbadense," or "Sea Island." These are the most common varieties, the ones with which we are all familiar, and from which are mostly derived the multitude of sub-varieties now claiming your attention. But from such a small number to begin with, how is it that there have been so many varieties formed? Principally by one or both of two ways. First, by careful selection, combined with high cultivation, and second

by hybridization.

As in the breeding of stock, in order to succeed, it is necessary to have a certain standard in view; so it is in the formation of varieties of plants. First determine what you want—have a fixed standard in view. Then go to your plants, whatever they may be, and select carefully that one which comes the nearest to fillng these requirements. Then carefully gather the seed of that plant and in the proper season plant them. Again exercise the same care in selecting your seed and repeat the operation until you finally reach the object required. It takes time for this, and there are frequent disappointments. The improvement of plants by this method is no new thing—from time immemorial it has been practiced. Some of the results, not only in flowers, but also in many of our vegetables, are wonderful. Who, to look at the magnificent roses of to-day, would, for an instant, imagine their original form. When it was first thought of making sugar from the beet, the tropical cane grower laughed at the idea of its ever being able to compete with him, but to-day the infant that he might have strangled with one hand has grown into a monster that threatens to devour him, and this has been largely accomplished by care in the selection of seed.

Hybridization is a more difficult method. Having two varieties of a plant, each possessing some good point, it is desired to combine these two points in one individual. For this purpose the flower of one is carefully fertilized with pollen of the other, and the resulting seed planted. But here again selection must be exercised. There is a tendency in all life, be it animal or vegetable, to return to the original form of its ancestors. Hence the first seed by this process will produce three different kinds of plants. There will be represented in the new crop each of the plants from which the cross was made, together with the true hybrid. These, the hybrid, should be carefully selected and this process repeated until finally the plants shall have attained the power of transmitting their properties to their offspring.

But do not misunderstand us as recommending every farmer to go into the business of originating varieties. At the most,

whether it be by selection or by hybridizing, it requires more time and patience than many of us possess. Some idea of the magnitude of such an undertaking can be gained by a brief sketch of the history of the Early Rose potato. The parent of this potato was the Black Chili, raised from seed imported from Chili. Its originator selected it as being the best of some 1600 varieties that, in the course of some ten years, he had tried. He gave a few seed of this variety to a friend, who planted them, and the product of which was the Early Rose. Thus it took over ten years to get this one variety.

But while it is of interest to know how varieties are obtained it is of vital importance that the farmer, having once obtained this variety, should know how to keep it up to the standards and to do this it is necessary to understand the agencies which affect plants.

While there are few of us who will admit his theory, yet all of us must acknowlege that Darwin was a great naturalist, and as he attempts to prove his theory by observed facts, you will pardon me if I present a few of them to you.

Both in animals and plants there is power, we might call it, known as atavism or the property of reverting to the original ancestors, and as we have seen how this multitude of varieties are formed, constant care in the selection of seed is necessary to overcome it. Again plants are greatly affected by any change in their surroundings, such as climate, soil, etc. We see this very plainly if for any purpose we plant, for instance, corn from a more northern climate. There the season is short and the plant must mature rapidly. The first season here it does this maturing much earlier than native varieties planted at the same time. The next seasonit is a little later, and finally takes aboutas long to mature as the native. It has then, as it were, become acclimated. We hear of spring and winter grain, but the botanist will tell you that there is no difference and that one can be converted into the other by a few years of patience. Lowland rice when sown on the upland does as well as when flooded and vice versa. You all know how readily the Irish potato is affected by

the kind of soil upon which it is grown. An excellent variety in a sandy soil may be a total failure in clay. The one that fails in loam may produce wonders in sond. Never was this more plainly illustrated than on this station this spring. Of 300 varieties planted, here, some of the most noted Eastern and Western potatoes were a total failure while others "to fame unknown" were wonders of success, the result of changed soil and climate

In comparing the table to which we have referred with a similar one from the station at Calhoun, there is a very striking difference in the per cent. of lint of the same varieties raised on the different stations. In nearly every instance this yield is greater at Calhoun than here. So universally is this the case that we cannot but suspect that the difference in soil and climate has even affected the growth of lint of the varieties.

There is yet another influence upon plant life, which we must not omit- It is known as the theory of the "survival of the fittest." By this we take it is not meant that which is the fittes- for man, but that which is best fitted for the conditions surt rounding the plant. Import a plant from a foreign clime, a grass for instance; plant it here and perhaps as long as you attend to it, it will do well, But the moment we turn it loose, as it were, the moment it is left to struggle for its own existance, the more hardy natives begin to encroach upon it, and in, at most, a few years it will have disappeared entirely, completely succumbed to perhaps a close relation, but one better fitted to withstand the hot suns, excess of moisture, or whatever it may be. In their process of adaptation to these changed conditions, plants are frequently so changed in some of their most prominent attributes that it becomes difficult to believe that they bear any relation to their former brethren. The knowledge of these agencies only emphasises the importance of selecting our seed not only of cotton, but of all crops. Let us now see how these laws would work in the case of cotton. Suppose we start with a good variety of long staple. This is probably the result of a cross between Sea Island and Upland. The first year we plant

the seed the deterioration commences. Ætavism asserts itself and there is a slight separation in some of the individual plants to one or the other parent, and the prepotency is always down-hill. Then, too, perhaps some stray insect, in search of the sweets of its flowers, has unwittingly conveyed to its ready pistil the pollen of some short staple native cotton, the result being another cross. As its name indicates, the Upland cotton is the best fitted for the surrounding conditions, and this being the case, our hybrid, in the effort to adapt itself to the changed condition, begins to shorten its staple. As the result of this, unless careful selection is constantly practiced, instead of a fine variety we have in a few years nothing but the ordinary cotton of our neighbor.

We have not thought it worth while in this paper to lay any stress upon the importance of thorough cultivation, as we presume that any one who is sufficiently awake to select his seed will appreciate its necessity. But from what we have seen of the survival of the fittest, it is easy to infer that the man who does not practice thorough cultivation is doing worse than nothing by paying extra for choice seed, for he thereby not only wastes his moneys, but perhaps brings discredit upon a good variety.

All that has been said above has been in reference to the stalk from which to select the seed. To discuss here from what part of the stalk to take those seed, whether from the bottom, middle or top, whether to select those that first mature, or those from near the stalk, or at the extremity of the limb, would be rather an anticipation, as these are questions that have not yet been solved.

Now in concluding, we do not recommend each farmer to go into the business of orignating varieties. That is left to individuals and perhaps your Experiment Stations.

But we do urge upon each and all the importance of exercising the greatest care in the selection of their seed. The day is not far distant, in fact is even here when the kind of seed used is quite an item in the profit and loss account of each farmer, and

he who neglects it is bound sooner or later to go to the wall, to make way for a more careful successor.

We cannot close this report without thanking the following periodicals, who have been so kind as to furnish the reading-room of this station with their regular publications free :

Canadian Horticulturist, Grimsby, Ont,; Revue Agricole, Port Louis, Maurice; Sugar Review, London, England; Farmers Advocate, Ontario, Canada; Canadian Live Stock and Farm Journal, Hamilton, Canada; Journal des Fabricants de Sucre, Paris, France; Sugar Cane, Manchester, England; Agricultural Gazette, London, England; Journal of Chemical Society, London, England; Agricultural Students' Gazette, Cirencester, England; Gardeners' Chronicle, London, England; Chemical News, London, England; Live Stock Journal, Starkville, Miss.; Coleman's Rural World, St. Louis, Mo.; Southern Cultivator, Atlanta, Ga.; Elmira Husbandman, Elmira, N. Y.; Industrial South, Richmond, Va.; Home and Farm, Louisville, Ky.; Times-Democrat, New Orleans, La.; Picayune, New Orleans, La.; Sugar Beet, Philadelphia, Penn.; Country Gentlemen, Albany, N. Y.; Rural New Yorker, New York, N. Y.; American Agriculturist, New York, N. Y.; Agricultural Science, Knoxville, Tenn.; Lake Charles American, Lake Charles, La.; South Illustrated, New Orleans, La.; City Item, New Orleans, La.; States, New Orleans, La.; Bee, New Orleans, La.; Stadts Zeitiung, New Orleans, La.; Manufacturers' Record, New Orleans, La.; Industrial Review, New Orleans, La.; Christian Advocate, New Orleans, La.; Caligraph, Ruston, La.; Farmers' Union, Chaudrant, La.; Farmers' Club Journal, Hanselville, N. Y.; The Poultry World, Hartford, Conn.; Journal of Analytical Chemistry, Easton, Penn.; American Chemical Journal, Baltimore, Md.; Popular Science News, Boston, Mass.; The American Garden, New York, N. Y.; Orange Judd Farmers Chicago, Ill.; The Microcosm, Philadelphia, Penn.; The Weekly Truth, Baton Rouge, La.

The thanks of the station are also due to those enterprising agricultural implement makers Messrs. B. F. Avery & Co., for implements; also to Mr. W. S. Roberts, the courteous agent of Clarke's Cutaway Harrow, for one of those fine implements, and to many others for various favors.

BULLETIN No. 27.

REPORT

OF THE

NORTH LA. EXPERIMENT STATION,

OF THE

LOUISIANA STATE UNIVERSITY AND A. & M. COLLEGE,

AT

CALHOUN, LA.

FOR 1889.

WM. C. STUBBS, PH. D., Director.
JORDAN G. LEE, Assistant Director.

ISSUED BY THE BUREAU OF AGRICULTURE,
T. J. BIRD, Commissioner.

PRINTED AT THE TRUTH JOB OFFICE,
BATON ROUGE, LA.

THE AGRICULTURAL EXPERIMENT STATION,

LA. STATE UNIVERSITY AND A. & M. COLLEGE.

The bulletins and reports will be sent free of charge to all farmers, by applying to Major T. J. Bird, Commissioner of Agriculture, Baton Rouge, La.

LOUISIANA STATE UNIVERSITY AND A. AND M. COLLEGE,
OFFICE OF EXPERIMENT STATIONS,
Baton Rouge, La.

To Major T. J. Bird, Commissioner of Agriculture:

Dear Sir:—I hand you herewith the Annual Report of North Louisiana Experiment Station by Major J. G. LEE, Assistant Director and Chemist, and ask that you publish it as Bulletin No. 27.

Respectfully submitted,
WM. C. STUBBS, Director.

NORTH LOUISIANA EXPERIMENT STATION,
Calhoun La., December 1889,

To Dr. W. C. Stubbs, PH. D., Director:

Dear Sir:—In accordance with your request, I herewith hand you annual report of crop results on this Station for the year ending December 1889.

In the main the results are gratifying.

Permit me to say, the station is doing good work for North Louisiana and great enthusiasm is exercised as is testified by the outpourings of farmers at the regular monthly meetings of the North Louisiana Agricultural Society and the daily visits of farmers during growing seasons.

In the preparation of this Bulletin I am specially indebted to Mr. L. M. Calhoun, farm manager, for his assistance in calculating and compiling results.

Respectfully submitted.
JORDAN. G. LEE,
Assistant Director and Chemist

REPORT.

The present year has been very successful and gratifying at this Station. Thirty acres of the pooiest land were plattep and have been devoted permanently to field experiments in manures with various crops. Another field, of 20 acres, is to grasses, grains and clovers, 10 to vineyard, orchard, garden and truck patches, fifty to general field crops and the rest divided into pastures for different breeds of stock.

To the live stock already on hand and previously reported, the station has added the following breeds of Hogs: Red Duroc or Jersey; White Chester; Essex, Bershire and Yorkshire, and the following breeds of Sheep: Cotswold, Merino, Southdown and Shropshire. With each fine breed have been placed two common ewes for grading purposes.

All stock are doing well and are in good healthy growing condition. In the introduction of improved breeds of Stock, the station aims to benefit this portion of Louisiana by determining which kinds are best adapted to this section, and further to give practical lessons in the principles which underlie stock feeding and stock breeding. At no time does the station contemplate keeping more live stock than will answer the purposes of experimentation.

Prices have therefore been fixed by a Committee appointed by the North Louisiana Agricultural Society for that purpose, for all sales and service fees of males. Live Stock will also be sold at public auctions, at meetings of this Society, thus given farmers the opportunity to buy.

The prices fixed for chickens are $1 50 for single cock, $2 00 per pair, or $3 00 per trio. For pigs $2 50 per head. For service fees of bull $3 00; for hogs, $1 00. Other prices have not been reported. Arrangements are made for taking care of all stock sent, and under no circumstances will males be permitted to go off the farm to do service.

Rubina, the Holstein cow, bought of Mr. J. W. Howard, Aberdeen, Miss., and of the celebrated Aggie family, has made a record this year of seven gallons milk per day, and two lbs. butter. Beautiful Princess, bought of Dr. Wm. E. Oates, Vicksburg, Miss., and of the famous Stoke Pogis and St. Lambert strain, has made a record with her first calf, of four gallons milk per day and two pounds of butter.

The following record of eggs laid by each breed of chickens was carefully kept from January until April: Langshans, 2 hens, 96 eggs; wanted to brood twice. Minorca, 2 hens, 86 eggs; Brown Leghorn, 2 hens, 81 eggs; Partridge Cochins, 2 hens, 79

eggs, wanted to brood, four times; Light Bramahs, 2 hens, 76 eggs, wanted to brood once; Buff Cochins, 2 hens, 59 eggs, wanted to brood three times; White Plymouth Rock, one hen, 50 eggs; Barred Plymouth Rock, one hen, 34 eggs; Wyandotte, 1 hen, 11 eggs; Silver Spangled Hamburg, was not put on record until March 1st, and one hen laid 16 eggs in that time; a Pekin Duck laid 23 eggs during this period. Remarks are withheld for the present on the different breeds. A careful record will again be kept, for entire year, together with such characteristics of good and bad points as may appear and will be published when fair trial has been given.

The station has recently erected a large and commodious hall 40x60 feet, built for the purposes of the North Louisiana Agricultural Society, which holds its meetings here the last Thursday in each month. The organization of this society dates from the establishment of this Station. Its officers are J. M. White, of Lincoln, President, and L. G. Drew, of Ouachita, Secretary. The society is composed of farmers and planters of North Louisiana, and its good work in promoting agriculture and agricultural methods and implements, is already felt throughout this portion of the State.

Farmers of this section are enthusiastic over the Station and attend in large numbers the monthly meetings of the Society in Agricultural Hall. The V. S. and P. R. R. has liberally contributed to this movement by running excursion trains on the day of meeting from Vicksburg and Shreveport, thus giving the farmers, at a reduced cost, an opportunity of inspecting the work of the Station and of enjoying the benefits of the discussions of the North Louisiana Agricultural Society.

A Silo 8x8 feet was erected in the barn during summer and filled with Indian corn, Large African millet and Millo maize. The silo has just been opened and the ensilage found to be very good, so pronounced by Dr. W. C. Stubbs, Dr. S. A. Knapp and Prof. B. B. Ross. Its palatability has been tested by stock, and though tasting it at first timidly, they now eat it well.

The orchard is in good condition. But few trees were lost

and these have been replaced by others. A full list and number of varieties were given in Bulletin 22. Special care and attention will be given to orchard and garden for the Station has great hope of the fruit and vegetable industries in this section of State.

Six acres in small grains, barley and oats, were planted in November. One acre of each was fertilized with 200 lbs. cotton seed meal and 100 lbs. acid phosphate. One acre of each will be top dressed in spring, and one acre of each will remain unfertilized.

Six acres, besides the small plats have been planted in grasses and clovers. viz: one half acre each of Red, White, Burr and Alsike clover and Lucerne, and one half acre each of Kentucky, English Rye, Red Top, Rescue, Tall Meadow Oat and Orchard grasses. Only fair stands have been obtained of some, others quite good. Report will be made of results, next year.

The following is a report of all crops harvested on Station during the year ending December, 1889:

GRAINS AND GRASSES.

Small grains and grasses were planted on very poor soil, from which a heavy crop of pines and persimmon bushes had just been removed. Land was broken in July, 1888, with 2 horse Avery plow, cross broken with straight scooters Oct. 2 and 3. Sowed grain and manures Oct. 16 and 17, and plowed in broadcast with scooter plow and harrowed off. The grains were harvested from May 10 to 18th.

VARIETIES OF GRAINS.

Name of Variety.	Bushels of grain per acre.	Pounds of straw per acre.
Centennial Oat	24.50	2805
Hulless Barley	13.75	3080
Champion Barley	13.75	1567
Martin's Amber Wheat	3.43	1443
White Russian do.	17.41	3587
Saskatchewan do.	13.40	3861
Michigan do.	5.50	1760
White Clawson do.	4.58	2310
Armstrong do.	3.66	1815
Scotch Fife do.	17.86	4318

Below are experiments of grain with fertilizers :

NAME OF VARIETY	Kind and quantity manure used per acre.	Bushels of grain per acre.	Pounds of straw per acre.
Red Rust Proof Oat	100 bush. cotton seed	59.28	3190
do.	75 " " "	65.31	2485
do.	50 " " "	33.50	1678
do.	500 lbs. c. seed meal	51.56	2612
do.	300 " " "	36.09	1485
do.	no manure.	15.47	715
do.	" "	25.78	935
Winter Barley	100 bush. cotton seed	34.37	2750
do.	300 lbs c. seed meal	11.45	935
do.	no manure.	nothing.	----

On April 11th, the following remarks were made :

"Saskatchewan Wheat begins to head, slight rust. White Clawson Wheat, heavy rust. Martin's Amber Wheat, heavy rust. Scotch Fife Wheat, slight rust, doing well. White Russian Wheat, slight rust, doing well. Michigan Wheat, heavy rust, not doing well." Scotch Fife and White Russian Wheats were a fair success, both yielding a good harvest, but little rust, and grain kept well. These two have been planted again. The others "rusted" badly and the weevils destroyed the grain. They were not planted again.

Hulless Barley grows off rapidly, tillers but little, and yields a fair crop of hulled grain ; affords poor grazing.

Champion Two-Rowed Barley grows rapidly, yielding good grain.

Winter Grazing Barley should be planted on rich soil in September at rate of one and one-half to two and one-half bushels per acre ; grows fast and tillers extensively, soon covering the ground and affording an excellent winter pasture for grazing or soiling ; also yields heavy grain. A small plat has been planted for soiling purposes and now furnishes stock with green food.

CLOVERS.

Lucerne (*Medicago Sativa*) has not been a success thus far. A few years are required to test it. Blooms in May.

Alsike (*Trifolium Hybridum*). Unsatisfactory test, having poor stand.

Bokahra (*Melilotus Alba*). Poor stand. Resembles the Lucerne in growth. Blooms in May.

Red Clover (*Trifolium Pratense*). Stand not good, but furnishes fine samples of this variety.

A melilotus, or sweet clover, so extensively cultivated in the canebrake regions of Alabama, was planted in March, was a success in growth sufficient to furnish a light mowing.

Crimson Clover (*Trifolium Incarnation*) is an annual ; should be planted early in September on rich soil ; grows luxuriantly, and allows mowing in the spring.

White Clover (*Trifolinm Repens*). Not a full stand, and an unsatisfactory experiment.

GRASSES.

Kentucky Blue Grass (*Poa Pratensis*). Very satisfactory, covering the plat entirely in spite of being somewhat affected by prolonged drouth last summer.

Velvet Grass (*Holcus Lanatus*). In beginning of season this plat promised good results, but died during the drouth.

English Rye Grass (*Lalium Perenne*) Planted in October will give excellent pasturage in early spring. Grows five to ten inches in height.

Italian Rye Grass (*Lalium Italicum*) has given good results and matures early. Is an annual, and grows from eight to twenty inches in height. Somewhat injured by drought.

Texas Blue Grass (*Poa Arachnifera*) has given best results of winter grasses planted. Should be set out in September or October, with stalks eight or ten inches apart, as it tillers rapidly and soon mats] the plat. Goes to seed in May. Grows two feet high.

Randall Grass (*Festuca Pratensis*) was not a successful experiment.

Festuca Elatior gave poor results.

Rescue (*Bromus Uniolides*) did not come to a good stand.

Timothy (*Phleum Pratense*) suffered from drought, and was not a successful experiment.

Red Top Grass (*Agrostis Vulgaris*) gave favorable results, growing from fifteen to eighteen inches high, and yielding good quality of hay.

Orchard Grass (*Dactylis Glomerata*) and Tall Meadow Oat Grass (*Arrhenatherum Elatior*) gave promise of good results, but were affected severely with drought.

Giant Spurry was a partial success, growing ten to twelve inches in height. Seeds in May. Live stock are very fond of it.

FIELD EXPERIMENTS.

Plats A, B and C were devoted to rotation of crops. The rotating crops are oats, peas, cotton and corn. On plat A oats were sown in February, harvested in May and plat sown in peas in June. On plat B was planted cotton, and on plat C corn. In October plat B was sown in oats, to be followed by peas next spring, and plat C to be planted in cotton, following the corn, and plat A to be planted in corn, following oats and peas. This rotation will be kept up for a series of years. During that time the east half of each plat will be manured with an appropriate fertilizer ; the west half unmanured.

The object of these experiments is to determine how much our lands may be "built up" simply by rotating crops, fertilized and unfertilized, the rotating crops being oats, peas, corn and cotton. A careful record will be kept each year of each half plat, and results published.

Below is a statement of results :

Plat A. The fertilized half yielded twelve bushels of oats per acre. The unfertilized half 7.25 bushels. The same plat, planted in peas in June, yielded : fertilized plat 8.45 tons pea vines per acre ; unfertilized plat 4.22 tons.

The peas grew very rank, and were left standing to be plowed under in January with two-horse turn plow, the plat to be planted then in corn.

Plat B, was planted in cotton. Land well prepared, and first half of plat was fertilized with cotton seed compost at rate of 44 bushels per acre, drilled. The formula being,

One ton of acid phosphate,

100 bushels stable manure,

100 bushels cotton seed meal.

The fertilized plat yielded 829.22 lbs. seed cotton per acre, and the unfertilized plat 528 lbs.

This has already been sown in oats that are now up and growing nicely.

Plat C. Land was well prepared and planted in corn March 12. The first half plat was fertilized with corn compost, consisting of

One ton acid phosphate,

200 bushels stable manure,

200 bushels cotton seed

applied in the drill, one handful to hill at time of planting, and same quantity applied June 3d, covering with two furrows of turn plow.

The second half plat was left unfertilized. The manured plat yielded 17.73 bushels shelled corn per acre, and second half plat, 13.09 bushels. This plat will be planted in cotton the ensuing year. The very line, marking where the fertilizers stopped in this plat, was strikingly indicated in the growth of crop, and was so marked as to elicit comment from visitors.

COTTON.

Experiments in cotton were of three kinds. 1st, Manurial tests, embracing nitrogenous, phosphatic and potassic manures, and depths and application of manures; 2d, varieties; 3d, distance.

Plat No 1 was devoted to nitrogenous manures. The questions propounded to this plat are: 1st, Does this soil need nitrogen to grow cotton successfully? 2d, If so, in what form can it be best presented? 3d, In what quantities per acre?

In this plat nitrate of soda and sulphate of ammonia (mineral forms) have been tested with cotton seed meal and cotton seed, raw, rotted and composted (vegetable forms), and such quantities of each as to contain 24 and 48 pounds of nitrogen per acre. Where 24 pounds per acre were used, it is denominated as one

ration, and two rations where 48 pounds. There are six groups of four experiments each, viz: 1, The nitrogenous fertilizer alone. 2. Mixed minerals, i. e. a mixture of acid phosphate and kainite. 3, One ration of the nitrogenous fertilizer combined with mixed minerals, and 4, Two rations of the nitrogenous fertilizer combined with mixed minerals. In addition to above, two experiments have been left unmanured to secure the natural capacity of the soil—a starting point for calculatlng the benefits of the fertilizer used. By comparing the experiments where nitrogen is used alone with those unmanured, we get the benefit of nitrogen uncombined. By comparing those, where nitrogen combined with mixed minerals, has been used, with those where mixed minerals alone have been used, we get the benefit due to nitrogen combined. By comparing results of each form combined and uncombined with its own mixed minerals and expressing the results in percentages of the last, the relative merits of each form of nitrogen may be determined. By comparing the results of the one and two rations, deflnite ideas as to quantity of nitrogen to be used per acre may be acquired. Were the capacity of the soil of this plat uniform, results could be expressed in pounds instead of percentages. But it was very irregular, as the experiments show.

CULTIVATION OF PLAT.

Planted April 9th. Fertilizers distributed in drill, covered and seed bed opened and seed planted and covered with harrow. Cultivated with side harrow May 3, with scooter and scrape May 17 and 21—with shovel and large scrape June 18 and 25. Hoed June 5 and 24th.

Plat No. 1,--Cotton Nitrogen Experiment.

No. expt.	Kind and Quality of Manure used per Acre.	Yield of cotton in seed per acre.
		pounds
1	160 lbs. Nitrate Soda	1720
2	240 lbs. Mixed Minerals	1180
3	240 lbs. Mixed Minerals 160 lbs. Nitrate Soda	1900
4	240 lbs. Mixed Minerals 320 lbs. Nitrate Soda	2140
5	120 lbs. Sulphate Ammonia	1530
6	240 lbs. Mixed Minerals	1300
7	240 lbs. Mixed Minerals 120 lbs. Sulphate Ammonia	1630
8	240 lbs. Mixed Minerals 240 lbs. Sulphate Ammonia	1790
9	No Manure	840
10	360 lbs. Cotton Seed Meal	1310
11	240 lbs. Mixed Minerals	760
12	240 lbs. Mixed Minerals 360 lbs. Cotton Seed Meal	1470
13	240 lbs. Mixed Minerals 720 lbs. Cotton Seed Meal	1520
14	1040 lbs. Crushed Cotton Seed	1130
15	240 lbs. Mixed Minerals	660
16	240 lbs. Mixed Minerals 1040 lbs. Crushed Cotton Seed	1000
17	240 lbs. Mixed Minerals 2080 lbs. Crushed Cotton Seed	1260
18	No Manure	490
19	1040 lbs. Rotten Cotton Seed	860
20	240 lbs. Mixed Minerals	520
21	240 lbs. Mixed Minerals 1040 lbs. Rotten Cotton Seed	820
22	240 lbs. Mixed Minerals 2080 lbs. Rotten Cotton Seed	950
23	4200 lbs. Compost	910
24	240 lbs. Mixed Minerals	600
25	4200 lbs. Compost 80 lbs. Kainite	1060
26	8400 lbs. Compost 80 lbs. Kainite	1450

*Mixed Minerals consist, at rate per acre, of 160 lbs. Acid Phosphate with 80 lbs. German Kainite.

CONCLUSIONS.

The answer to the first question, "Does this soil need nitrogen?" is very positive. Both the "nitrogen alone" experiments and the "nitrogen combined with mixed minerals" give conclusive results. The average of the experiments where no manure was used is 665 lbs. per acre. The average of the nitrogen alone experiments is 1310 lbs., showing a gain due to nitrogen of 645 lbs. per acre. The average of the experiments with mixed manures is 835 lbs. The average of one ration of nitrogen combined with mixed minerals is 1216 lbs., while that of two rations

combined with mixed minerals is 1518 lbs., showing an excess due to one ration of nitrogen of 411 lbs, and to two rations of 683 lbs. These experiments are very positive in favor of the wants of this soil for nitrogen.

The second question, "In what form is nitrogen best presented," is not definitely answered. The excesses of nitrate of soda uncombined and combined over its "mixed minerals" are respectively 540, 720 and 950 lbs or 46 per cent,, 61 per cent,, and 81 per cent., over yield of mixed minerals. The excesses of sulphate of ammonia, uncombined and combined, over its mixed minerals are respectfully 230, 330 and 490 lbs., or 18 per cent, 25 per cent and 38 per cent over yield of mixed minerals.

The excesses of cotton seed meal, uncombined and combined, over its mixed minerals, are respectively 550, 710 and 760 lbs., or 72 per cent., 94 per cent., and 100 per cent., over yield of mixed minerals. The excess of crushed cotton seed are 470, 340 and 600 lbs. respectively, or 71 per cent, 51 per cent. and 91 per cent. over the yield of its mixed minerals.

Rotten cotton seed gives likewise increased yields of 340, 300 and 430 lbs., or 65 per cent., 58 per cent., and 83 per cent., over mixed minerals.

By thus comparing each form of nitrogen with its own mixed minerals and reckoning the excess in percentages of the latter a true estimate of the value of nitrogen can only be obtained. By this we find that cotton seed meal has given slightly best results, with the crushed cotton seed and rotten cotton seed following. These results are, however, not to be interpreted as condeming the other forms af nitrogen—for they are known to be valuable. They rather tend to establish the fact that nitrogen from cotton seed or meal is a most excellent form.

The third question, "In what quantity to be used?" is perhaps answered definitely from a pecuniary standpoint. Two rations have given excesses over one ration of respectively 20 per cent., 13 per cent., 6 per cent., 40 per cent., and 25 per cent. —or, 240. 160, 50, 260 and 134 lbs. of seed cotton per acre. Each ration contains 24 lbs. nitrogen costing 19½ cents per lb. or

$4 68-100 per acre. If seed cotton be estimated at three cents per pound, only two of the above show a profit, while three show a loss. It is therefore of doubtful propriety to use a quantity of nitrogen per acre, greater than 24 lbs. especially on very poor soils.

PLAT NO. 2—COTTON PHOSPHATE EXPERIMENTS.

Here the various forms of phosphoric acid are used alone and combined, and in quantities of one and two rations.

Since every good acid phosphate or dissolved bone must contain a large quantity of gypsum, (land plaster,) there has been used in small experiments only gypsum, to see how far the results from experiments with acid phosphate or dissolved bones are due to the presence of this substance.

In this plat the same questions are propounded with Phosphoric Acid Manures as are propounded with nitrogen in Plat 1, viz: 1, Does this soil need phosphoric acid to grow cotton successfully?" 2, "If so, in what form can it best be presented?" 3, "In what quantities per acre?" Cultivation same as plat 1. The following are results:

Plat No. 2.---Cotton Phosphate Experiments,

No. Experim't	Kind and Quantity of Manure used per Acre.	Yield cotton seed per acre.
1	80 lbs. Gypsum	1520 lbs.
2	160 lbs. Dissolved Bone Black	1630 "
* 3	480 lbs. Cotton Seed Meal, 120 lbs. Kanit } Basal Mixture	1970 "
4	600 lbs. Basal Mixture, 160 lbs. Dissolved Bone Black.	1920 "
5	600 lbs. Basal Mixture, 320 lbs. Dissolved Bone Black.	2060 "
6	80 lbs. Gypsum	1390 "
7	160 lbs. Acid Phosphate	1350 "
8	600 lbs. Basal Mixture	1720 "
9	No Manure	1010 "
10	600 lbs. Basal Mixture, 160 lbs. Acid Phosphate,	1480 "
11	600 lbs. Basal Mixture, 320 lbs. Acid Phosphate,	1420 "
12	160 lbs. Bone Meal	770 "
13	600 lbs. Basal Mixture	1170 "
14	600 lbs. Basal Mixture, 160 lbs. Bone Meal,	1270 "
15	600 lbs. Basal Mixture, 320 lbs. Bone Meal,	1340 "
16	160 lbs. Floats	480 "
17	600 lbs. Basal Mixture	920 "
18	600 lbs. Basal Mixture, 160 lbs. Floats,	830 "
19	600 lbs. Basal Mixture, 320 lbs. Floats,	840 "
20	No Manure	330 "

INFERENCES FROM THIS PLAT.

No decided conclusions can be drawn from these experiments, due largely, doubtless to the variation in soil. That phosphoric acid is needed by these soils is perhaps established, though the evidence in favor of it is by means so overwhelming as with nitrogen. It is also probable that only the soluble forms of phosphoric acid are immediately available in profitable returns. It is beyond cavil, that excessive quantities are not remunerative.

In this plat the same questions are propounded with potash manures as are propounded with nitrogen in Plat 1, viz : 1st, "Does this soil need potash to grow cotton successfully?" 2, "If so, in what form can it be best presented?" 3, "In what quantities per acre?" Cultivation same as Plat 1. The following are results.

Plot No. 3, Cotton Potash Manures.

No. Expt.	Kind and Quantity of Manures used per acre.	Yield of seed cotton per acre.
1	360 lbs. Cotton Seed Meal 240 lbs. Cotton Seed Hull Ashes	790 lbs.
2	360 lbs. Cotton Seed Meal 480 lbs. Cotton Seed Hull Ashes	800 "
3	120 lbs. Cotton Seed Hull Ashes	410 "
4	480 lbs. Cotton Seed Meal 240 lbs. Acid Phosphate } Meal Phosphate	1020 "
* 5	720 lbs. Meal Phosphate 120 lbs. Cotton Seed Hull Ashes	910 "
6	No Manure	490 "
7	160 lbs. Kainite	450 "
8	720 lbs. Meal Phosphate	1080 "
9	720 lbs. Meal Phosphate 160 lbs. Kainite	1030 "
10	720 lbs. Meal Phosphate 320 lbs. Kainite	1100 "
11	40 lbs. Muriate Potash	530 "
12	720 lbs. Meal Phosphate	1270 "
13	720 lbs. Meal Phosphate 40 lbs. Muriate Potash	980 "
14	720 lbs. Meal Phosphate 80 lbs. Muriate Potash	940 "
15	No Manure	400 "
16	60 lbs. Sulphate Potash	410 "
17	720 lbs. Meal Phosphate	1120 "
18	720 lbs. Meal Phosphate 60 lbs. Sulphate Potash	1020 "
19	720 lbs. Meal Phosphate 120 lbs. Sulphate Potash	1130 "

*Meal Phosphate consists of 480 lbs. of Cotton Seed Meal with 240 pounds of Acid Phosphate to the acre.

In this plat potash has been used in the following forms: kainite, Cotton hull ashes and the muriate and sulphate of potash. Such quantities of each have been taken as to represent one and two rations of potash.

CONCLUSIONS.

That Potash has not been beneficial to cotton on this soil in any form or quantity.

PLAT NO. 4—COTTON.—DEPTH OF MANURE.

The questions propounded to this plat are, 1st. "What depth shall we apply fertilizers for best results?" 2, "Shall they be combined or separate?" and incidently the question is asked, "Do fertilizers affect germination in shallow application!" Following are results;

1st. Plat No. 4. Cotton, Depth of Manure.

No. Exper't.	Kind and quantity manure used per acre.	How deep applied.	Yield of cotton in seed per acre.
1	160 lbs. Acid Phosphate, 40 " Muriate Potash, 360 " Cotton Seed Meal	6 to 8 inches	920 lbs.
2	160 " Acid Phosphate, 40 " Muriate Potash 360 " Cotton Seed Meal.	4 to 5 inches	920 "
3	160 " Cotton Seed Meal. 40 " Muriate Potash 360 " Cotton Seed Meal	2 to 3 inches	1030 "
4	160 " Acid Phosphate, 40 " Muriate Potash 360 " Cotton Seed meal	Top Dressed	870 "

From 6 to 8 inches and 4 to 6 inches give equal results, 2 to 4 inches give best and "top dressed' poorest yields.

PLAT NO. 4—COTTON. DEPTH OF MANURE USED SEPARATELY.

In this plat Cotton Seed Meal is left off in Experiments 1 and 2, combined in double quantity in 3, and in same quantlity applied shallow in 4.

Plat No. 4. Cotton—Depths cf Manure used Separately.

No. Exper't.	Kind and quantity Manure used per acre.	How deep applied.	Yield in seed cotton per acre.
1	320 lbs. Acid Phosphate 80 " Muriate Potash	6 to 8 inches	740 lbs.
2	320 " Acid Phosphate 80 " Muriate Potash	Top Dressed	680 "
3	320 " Acid Phosphate 80 " Muriate Potash 720 " Cotton Seed Meal	2 to 3 inches	1400 "
4	320 " Acid Phosphate 80 " Muriate Potash 720 " Cotton Seed Meal	4 to 5 inches Top Dressed	1140 "

It is claimed that the three chief ingredients of commercial fertilizers have different capacities of diffusion through a soil. Potash becomes fixed as soon as it comes in contact with a soil: Phosphoric acid rarely descends deeper than a few inches, even when applied in its most soluble form ; while nitrogen is very diffusible, rising or falling in a soil, according to the amount of moisture present. It descends with the drainage water, when an excess of the latter prevails, and rises in dry weather with the capillary moistnre and is left at or near the surface, when the latter is evaporated. The questions then are, 1st. "At what depth shall we apply our manures to accomplish the greatest availability," and 2d, "Shall we apply each ingredient separately and at different depths !"

These experiments are made merely to obtain suggestions on this subject, hoping, some day to undertake a thorough investigation of the subject. It is suggested by these experiments, that with a complete fertilizer on these soils, the best results are to be obtained by applying at a depth of about 2 to 3 inches. Where cotton seed meal was used as a top dressing at time of planting, germination was effected.

PLAT 4—COTTON VARIETIES.

There are many varieties of cotton offered yearly on our market with flaming certificates of great excellence and eulogistic testimonials of high merit. The station has tested this year as many of these varieties as could be obtained, at a great cost of labor, time and money. They were placed under exactly the same conditions and treated, as nearly as possible, alike. Excellent stands were obtained and with great care they were chopped out, leaving one stalk in hill at equal intervals. They were picked and weighed and each variety separately ginned on an improved 20 saw Gullett gin with feeder and condenser, and lint and seed each carefully weighed. Samples were reserved and have been sent to New Orleans for classification as to quality of lint. The following are results :

PLAT NO. 4, COTTON VARIETIES.

No. Experiment	NAME OF VARIETY.	Yield per acre in seed.	per cent of seed.	per cent of lint.	Yield of lint per acre.	REMARKS.
1	Allen's Long Staple	1898 lbs.	67.60	30.71	582 lbs.	Second year here, originally from Ga.
2	Allen's Long Staple	1802 "	66.50	32.28	581 "	Third " " " " "
3	Tennessee Silk	1636 "	67.90	31.81	519 "	Seed obtained from New Orleans.
4	Tennessee Silk	1470 "	66.50	31.31	460 "	Home raised, from New Orleans.
5	Jones' Improved	1400 "	67.30	31.40	439 "	From Georgia.
6	Oats	1365 "	66.16	33.08	451 "	From Public Gin Baton Rouge.
7	Little Brannon	1233 "	64.55	34.74	428 "	From Station Baton Rouge.
8	Peterkin	1277 "	62.50	36.13	461 "	" " " " "
9	Peterkin. 2nd year	1242 "	63.08	35.38	439 "	" " " " "
10	Bancrofts Herlong	1330 "	65.25	33.33	443 "	From Baton Rouge.
11	Petit Gulf	1067 "	67.00	32.69	348 "	From New Orleans.
12	King's Improved	1426 "	66.00	32.90	469 "	From Department Agriculture.
13	Carolina Pride	1198 "	67.55	31.81	381 "	From South Carolina.
14	Peeler's	1006 "	65.74	32.55	329 "	From New Orleans.
15	Peerless	918 "	65.33	33.66	308 "	From Georgia.
16	Dickson	822 "	66.00	33.00	221 "	From Georgia, Mr. Dickson.
17	Herlong	796 "	66.00	32.00	255 "	From New Orleans.
18	Hawkin's	892 "	64.29	33.66	300 "	From Department Agriculture Washington.
19	Jower's Improved	910 "	64.00	34.00	309 "	From Georgia.
20	Shine's Early	980 "	66.04	33.49	328 "	From Dep't Agriculture Washington D. C.
21	Wilbourn's Pet	1050 "	65.00	32.50	341 "	From Georgia, Home raised.
22	McGhee's Southern Hope	910 "	67.75	32.80	298 "	From Mr. McGhee, Miss.
23	Wilbourn's Pet	945 "	66.00	31.40	296 "	From Department Agriculture D. C.
24	Cherry's Cluster	1102 "	64.46	34.71	382 "	" " " " "
25	Cherry's Long Staple	1128 "	66.95	32.20	366 "	" " " " "
26	Martins' Prolific	1321 "	66.17	32.35	427 "	" " " " "
27	S. Maxey's	1470 "	66.23	32.46	477 "	
28	Boyd's Prolific	1435 "	66.65	32.45	465 "	From Baton Rouge.
29	Boyd's Prolific	1662 "	66.00	32.30	536 "	From Home raised
30	Crawford's	1907 "	65.45	32.83	626 "	From Georgia.
31	Trentt's Improved	1548 "	67.00	32.47	502 "	" "
32	Ellsworth	1785 "	68.48	31.58	563 "	" "
33	Deering Small Seed	1286 "	62.25	37.25	479 "	
34	Grayson's Early Prolific	1793 "	66.33	32.16	576 "	From Mr. Grayson, Columbia, La.
35	Ben Smith's Choice	1338 "	65.24	32.88	439 "	From Mr. Ben Smith, Vernon, La.
36	Okra	1089 "	66.00	34.17	382 "	From Georgia.
37	Sea Island	682 "	70.90	26.36	179 "	Home raised.
38	Mikado	1225 "	65.24	32.08	392 "	

Planted Mikado Cotton April 23rd.

A close inspection of above table shows that theyield of seed cotton per acre, (excluding Sea Island,) varies from 796 lbs. to 1898 lbs, while the yield of lint per acre runs from 255 lbs. to 626 lbs. Deering's Small Seed gives the largest per cent of lint, followed closely by Peterkin. Attention is directed too, to per cent of lint of Little Brannon, Cherry's Cluster, Okra, Peerless, Oats, Bancroft's Herlong, Jower's Improved, Shines' Early, Hawkin's and Dickson. Some of the varieties have not had equal showing with others, and judgment must be withheld until they are further tried. A very poor strip of land passes through near the center of plat, embracing several experiments, while the first three or four experiments occupy stronger land. Still a close inspection of varieties show many of them to be without any apparent merit on this soil. Caution is therefore necessary on the part of farmers before they procure new seed in large quantities, or abandon an old and tried variety for a new, untried one. It is best to await trials and approval by Experiment Station of all new crops before any considerable investment in seed. On application the Station can furnish small quantities of seed of any of above varieties.

PLAT V.—COTTON—DISTANCE.

The question propounded to this plat is "What distance shall cotton be planted in drill for best result in this soil, and incidentally what is the effect of topping cotton ?" Three rows were devoted to each experiment and two of these rows were topped and one left untopped. Cotton was fertilized with cotton seed meal and acid phosphate. Following are results :

No. Experim't	Distance apart and No. of Stalks in Dril.	Yield per acre of Seed Cotton from topped stalks.	Yield per acre of Seed Cotton from untopped stalks.	Excess of untopped over topped Cotton per acre.
1	1 stalk 8 inches in drill	1928 lbs.	1942. lbs.	+ 14 lbs.
2	2 stalks 8 inches in drill	1601.25 "	1601.25 "	----
3	1stalk 12 inches in drill	1719.25 "	1942.50 "	+ 223.25 "
4	2 stalks 12 inches in drill	1929.25 "	2283.75 "	+ 354.50 "
5	1 stalk 16 inches in drill	1771.75 "	1811 "	39.25 "
6	2 stalks 16 inches in drill	1969 "	1942.50 "	— 26.50 "
7	1 stalk 20 inches in drill	1509.25 "	1653.75 "	+ 144.50 "
8	2 stalks 20 inches in drill	1745.5 "	1680 "	— 65.50 "
9	2 stalks 24 inches in drill	1509.25 "	1470 "	— 39.25 "

Experiment No. 4, two stalks, twelve inches in drill, gives largest average yield of topped and untopped cotton, yielding 2106.50 lbs seed cotton per acre. The next largest average is from Experiment 6, 2 stalks 16 inches in drill, yielding 1955.75 lbs., and the next is 1935 lbs. from Expert. 1, 1 stalk 8 inches.

A great deal has been said about the value of topping cotton. The above experiments and results seem to suggest the wisdom and economy of leaving cotton untopped.

The minus sign indicates the largest yield from topped cotton.

PLAT VI —COTTON. APPLICATION OF MANURES.

Nitrogen is very soluble. In the soil it is readily converted into ammonia, nitrates and nitrites, in which forms it is available as plant food, but the loose sandy character of this soil and the soluble character of nitrogen forces the belief that an unknown quantity of nitrogen is leached from the soil by rain and is therefore lost to the plant. The object of this plat is to determine if there is any loss occurring, and if there is any value in two or more applications of nitrogen manure during the stages of growth. The applications are made only of nitrogen fertilizers, for potash is stationary in the soil ; phosphoric acid nearly so, not leaching from it. The mineral mixture is constant throughout, while the nitrogen fertilizer and application of it varies, but only in form, as the same quantity is applied in the first, second and third applications.

The following are results :

Plat No. 4—Cotton. Application of Manures.

No. Experim't	Kind and Quantity of Manure used, per acre.	When Applied.	Yield of Cotton in seed per acre.
1	240 lbs. Mixed Minerals 160 " Nitrate Soda	at planting, April 11	1150 lbs.
2	240 " Mixed Minerals, 80 " Nitrate Soda, 80 " Nitrate Soda.	at planting, April 11 at laying by, June 28	1190 "
3	240 " Mixed Minerals, $53\frac{1}{3}$ " Nitrate Soda, $53\frac{1}{3}$ " Nitrate Soda, $53\frac{1}{3}$ " Nitrate Soda,	at planting, April 11 second working, June 3 at laying by, June 28	1190 "
4	240 " Mixed Minerals, 121 " Sulphate Ammonia,	at planting	1050 "
5	240 " Mixed Minerals, 60 " Sulphate Ammonia, 60 " Sulphate Ammonia,	at planting laying by, June 28	1130 "
6	240 " Mixed Minerals, 40 " Sulphate Ammonia, 40 " Sulphate Ammonia, 40 " Sulphate Ammonia,	at planting second working, June 3 laying by, June 28	1030 "
7	240 " Mixed Minerals, 360 " Cotton Seed Meal	at planting	1030 "
8	240 " Mixed Minerals, 180 " Cotton seed meal 180 " Cotton seed meal	at planting at laying by, June 28	970 "
9	240 " Mixed Minerals 120 " Cotton seed meal 120 " Cotton seed meal 120 " Cotton seed meal	at planting at second working at laying by	1030 "
10	240 " Mixed Minerals 60 " Nitrate Soda, 40 " Sulphate ammonia, 120 " Cotton seed meal	at planting	1080 "
11	240 " Mixed Minerals, Plus one half expt 10 Plus one half expt 10	at planting at laying by	1150 "
12	240 lbs. Mixed Minerals Plus one third expt 10 Plus one third expt 10 Plus one third expt 10	at planting at second working at laying by	1240 "
13	160 lbs. Acid Phosphate, 160 " Cotton seed meal, 30 " Sulphate Potash	at planting	870 "
14	160 lbs. Acid Phosphate, 30 " Sulphate Potash, 160 " Cotton seed meal,	second working, June 3	760 "

In experiment 10 all the nitrogen manures used on other experiments are combined, viz: nitrate soda, sulphate ammonia, cotton seed meal and the three applications made.

CONCLUSIONS.

The average of one application is..................1077.50 lbs.
The average of two applications is..................1110 "
The average of three applications is..................1120 "

Two applications yields 32.50 lbs. seed cotton more per acre than does one application, and three applications 10 lbs. more than two and 42.50 lbs. more than one. As the same quantity

is applied in one application as in application 2 and 3, the only cost involved is the labor. From these results it may be asserted that there was but very little profit arising from the double and triple applications of manure.

CORN.

EXPERIMENTS IN CORN

Were of two kinds. First, Manurial requirements, including under this head nitrogen, phosphoric acid and potash manures, and applications of manures. Second—varieties.

PLAT VII, CORN—NITROGENOUS MANURES.

The questions propounded are the same as those propounded with cotton in plat 1, viz ; "Does this soil need nitrogen to grow corn successully ?" 2nd "If so, in what form must it be presented ?" "3rd. "In what quantities per acre ?"

The mineral and vegetable forms of nitrogen have been used separately, and combined with mineral manures.

CULTIVATION.

Corn was planted in rows, 5 feet wide, 3 feet apart in drill, March 12th. Thinned April 16th and plowed with side harrow April 18th., with cultivator May 4th ; with shovel and heel scrape May 18th, and 27th, giving final cultivation with same plow.

Plat No. 7, Corn, Nitrogen Experiments.

No. Experim't	Kind and quantity of manure per acre.	Bushels Shelled corn per acre.
†1	No Manure	24.12
2	112 lbs. Nitrate of Soda	28.32
*3	168 lbs. Mixed Minerals	25.
4	168 lbs. Mixed Minerals 112 lbs. Nitrate Soda	24.26
5	168 lbs. Mixed Minerals 224 lbs. Nitrate Soda	25.57
6	84 lbs. Sulphate of Ammonia	20.
7	168 lbs. Mixed Minerals	15.
8	168 lbs. Mixed Minerals 84 lbs. Sulphate Ammonia	20.37
9	168 lbs. Mixed Minerals 188 lbs. Sulphate Ammonia	24.
10	No Manure	16.
11	Dried Blood	2[illegible].31
12	168 lbs. Mixed Minerals	13.
13	168 lbs Mixed Minerals 112 lbs. Cotton Seed Meal	15.
14	168 lbs. Mixed Minerals 224 lbs. Cotton Seed Meal	15.23
15	252 lbs. Cotton Seed Meal	17.
16	168 lbs. Mixed Minerals	9.
17	168 lbs, Mixed Minerals 252 lbs. Cotton Seed Meal	14.
18	168 lbs Mixed Minerals 504 lbs. Cotton Seed Meal	21.
19	No Manure	9.
20	728 lbs. Crushed Cotton Seed	12.
21	168 lbs. Mixed Minerals	6.
22	168 lbs. Mixed Minerals 728 lbs. Crushed Cotton Seed	14.
23	168 lbs. Mixed Minerals 1456 lbs. Crushed Cotton Seed	20.
24	728 lbs. Green Cotton Seed	17.
25	168 lbs. Mixed Minerals	11.
26	168 lbs. Mixed Minerals 728 lbs. Green Cotton Seed	19.
27	168 lbs. Mixed Minerals 1456 lbs. Green Cotton Seed	22.
* 8	No Manure	1[illegible].
29	2940 lbs. Compost	17.
30	168 lbs. Mixed Minerals	12.
31	56 lbs. Kainite 2940 lbs. Compost	14.
32	56 lbs. Kainite 5880 lbs. Compost	20.
33	728 lbs. Rotten Cotton Seed	17.
34	168 lbs. Mixed Minerals	12.
35	168 lbs. Mixed Minerals 728 lbs. Rotten Cotton Seed	18.

†Old turn and fence row formerly occupied this experiment.
*"Mixed Minerals" consists of two parts of Acid Phosphate with one parts of German Kainite. Fertilizers applied in drill at time of planting.

CONCLUSIONS.

It is perfectly safe to assert in positive terms that this soil needs nitrogen badly for the successful growing of corn, and perhaps the same may be said for every other crop. No form of nitrogen is positively preferred, which can be easily shown, by treating results as was done under similar experiments with nitrogen. Again the double quantity of nitrogen has not been remunerative.

PLAT NO. 8.—CORN.—PHOSPHORIC ACID.

In this plat the same questions are propounded to phosphoric acid as were propounded with cotton in Plat 2, viz: 1st. "Does this soil need phosphoric acid to grow corn successfully?" 2nd. "If so, in what form will it be best to present it? 3rd. "In what quantities per acre?"

Cultivation and application of manures same as in plat 7.

PLAT NO. 8. CORN—PHOSPHORIC ACID EXPERIMENTS.

No. Exp't	Kind and Quantity Manure Used Per Acre.	Bushels Shelled Corn Per Acre
1	56 lbs Gypsum	26.69
2	112 lbs Dissolved Bone Black	28
3	420 lbs Basal Mixture	25
4	420 lbs Basal Mixture, 112 lbs dissolved bone black	23
5	420 lbs Basal Mixture, 224 lbs dissolved bone black	21
6	56 lbs Gypsum	14.49
7	112 lbs Acid phosphate	13
8	420 lbs Basal Mixture	20
9	No manure	12
10	420 lbs Basal Mixture, 112 Acid phosphate	22.19
11	420 lbs Basal Mixture, 224 lbs. Acid phosphate	22.18
12	112 lbs Bone Meal	14.10
13	420 lbs Basal Mixture	17
14	420 lbs Basal Mixture, 112 lbs Bone meal	16
15	420 lbs Basal Mixture, 224 lbs Bone meal	19

CONCLUSIONS.

The results here would indicate the same inferences as for cotton, viz: That phosphoric acid is perhaps needed. That the soluble forms are to be preferred. That excessive quantities are unprofitable.

PLAT NO. 9.—CORN.—POTASH.

In this plat the same questions are propounded to potash as were propounded with cotton in Plat 2., viz: "Does this soil need potash to grow corn successfully?" 2nd. "If so, in what form can it be best presented?" 3rd. "In what quantities per acre."

Cultivation, etc., same as in Plat 7.

Following are results:

PLAT NO. 9.—CORN.—POTASH EXPERIMENTS.

No. Exp't.	Kind and quantity manure used per acre	Bushel shelled corn per acre
1	84 lbs. Cotton seed hull ashes	10
2	504 lbs. Meal phosphate	18
3	504 lbs. Meal phosphate, 70 lbs. ashes	19.38
4	504 lbs. Meal phosphate, 140 lbs. ashes	18.24
5	No Manure	13
6	112 lbs. German kainite	15.22
7	504 lbs. Meal phosphate	22
8	504 lbs. Meal phosphate, 112 lbs. German kainite	22.53
9	504 lbs. Meal phosphate, 224 lbs German kainite	25.18
10	28 lbs. Muriate potash	18
11	504 lbs. Meal phosphate	25.39
12	504 lbs. Meal phosphate, 28 lbs. muriate potash	24.11
13	504 lbs. Meal phosphate, 56 lbs. muriate potash	22.4
14	No manure	20.31
15	42 lbs. Sulphate potash	18.4
16	504 lbs. Meal phosphate, 42 lbs. sulphate potash	24.08
17	504 lbs. Meal phosphate, 84 lbs. sulphate potash	24
18	No manure	12

CONCLUSIONS.

These experiments fail to show that potash is required by this soil in any quantity or form to grow corn.

PLAT NO. 10.—CORN.—APPLICATION OF MANURES.

No. Experim't	Kind and quantity of manure used per acre.	When applied	Bushels shelled corn per acre
1	*168 lbs. Mixed minerals 112 lbs. Nitrate soda	At time of planting	22 bushels
2	168 lbs. Mixed minerals 56 lbs. Nitrate soda.	At planting	24 bushels
	56 lbs. Nitrate soda	At laying by	
3	168 lbs. Mixed minerals 37⅓ lbs. Nitrate soda	At planting	26 bushels
	37½ lbs. Nitrate soda	Second working	
	37⅓ lbs. Nitrate soda	Laying by	
4	168 lbs. Mixed minerals 84 lbs. Sulphate ammonia	At planting	19.5 bushels
5	168 lbs. Mixed minerals 42 lbs. Sulphate ammonia	At planting	20 bushels
	42 lbs. Sulphate ammonia	At laying by	
6	168 lbs. Mixed minerals 28 lbs. Sulphate ammonia	At planting	24 bushels
	28 lbs. Sulphate ammonia	Second working	
	28 lbs. Sulphate ammonia	Laying by	
7	168 lbs. Mixed minerals 252 lbs. Cotton seed meal	At planting	22 bushels
8	168 lbs. Mixed minerals 126 lbs. Cotton seed meal	At planting	24 bushels
	126 lbs. Cotton seed meal		
9	168 lbs. Mixed minerals 84 lbs. Cotton seed meal	At planting	28 bushels
	84 lbs Cotton seed meal	Second working	
	84 lbs. Cotton seed meal	Laying by	
10	168 lbs. Mixed minerals, 37⅓ lbs. Nitrate soda	At planting	21 bushels
	28 lbs. Sulphate ammonia 78 lbs. Cotton seed meal	" "	
11	168 lbs. Mixed minerals 18⅔ lbs. Nitrate soda 14 lbs. Sulphate ammonia 42 lbs. Cotton seed meal	At planting	25 bushels
	18⅔ lbs. Nitrate soda 14 lbs. Sulphate ammonia 42 lbs. Cotton seed meal	At laying by	
12	168 lbs. Mixed minerals 12 4-9 lbs. Nitrate soda 9⅓ lbs. Sulphate ammonia 26 lbs. Cotton seed meal	At planting	28.21 bushels
	12 4-9 lbs. Nitrate soda 9⅓ lbs. Sulphate ammonia 26 lbs. Cotton seed meal	Second working	
	12 4-9 lbs. Nitrate soda 9¾ lbs. Sulphate ammonia 26 lbs. Cotton seed meal	At laying by	

*"Mineral Mixture" consists of acid phosphate, with German kainite, at rate of 168 lbs. per acre.

CONCLUSIONS.

Dividing the manures into three applications has given on

an average 5.43 bushels of corn to the acre more than one, and 3.30 over two applications. Two applications gives an excess over one of 2.13 bushels. The increase for corn from applying the manures at different times is strikingly larger than for cotton. Can the tap root of cotton intercept the fleeing nitrogen at greater depths than the fibrous rooted corn ?

The above suggests the wisdom, especially on loose, sandy soils, of dividing the fertilizers intended for corn and applying it at different times during growth.

Incidentally this plat shows that a mixture of nitrogenous manures has no superiority over cotton seed meal as a fertilizer for corn, even when applied at intervals.

PLAT NO. 11—CORN VARIETIES.

This plat was well prepared and corn planted March 12th. It was fertilized with the Station's compost, mixed at rates of 200 bushels cotton seed, 200 bushels stable manure and 2000 lbs. acid phosphate, applied, one handful to the hill at time of planting, at rate of about 30 bushels per acre. Corn gathered September 22. It was weighed in shucks ; then shucked and shelled, and shuck, cob and grain weighed separately, and per cent. of each calculated. Results are as follows :

RESULTS OF PLAT XI—VARIETIES OF CORN.

No. of Experiment	Name of Variety.	Where Obtained	Yield Per Acre in Shucks	Per Cent Grain	Per Cent Cob	Per Cent Shucks	Yield Per Acre in Shucked Corn	Kind of Corn
1	Alabama	From Alabama	2040 lb	73.18	17.25	9.57	26.55	White Dent.
2	Calhoun Red Cob	From A. Calhoun, Calhoun	2608 "	75.25	13.20	11.55	26.95	Shoe Peg and Red Cob.
3	Patterson	From R. F. Patterson, Baton Rouge	2276 "	75.20	12.95	11.85	30.56	White Dent.
4	McQuade	From John McQuade, Baton Rouge	2125 "	75.30	15.70	9.00	28.57	" "
5	Welborn's Pet	From Alexander Seed Store, Augusta, Ga	1738 "	78.45	14.80	6.75	24.35	
6	McLendon	From R. W. McLendon, Ouachita	1781 "	79.90	12.95	7.15	25.40	Regular Shoe Peg Seed.
7	Blount	From N. S. Dougherty, Baton Rouge	1671 "	75.95	15.10	8.95	22.67	White Gourd Seed.
8	Mosby	From Department of Agriculture, Washington	1260 "	78.01	11.50	10.49	17.55	White Dent.
9	White Mexican	From D. R. Calder	915 "	72.00	14.66	13.24	11 77	" "
10	Champion White Peak	From Alexander Seed Company, Ga	680 "	74.00	20.00	6.00	8.99	" "
11	New Hickory King	" " " " "	1116 "	80.24	12.50	7.26	16.10	White Flint.
12	Champion	" " " " "	1040 "	70.95	17.25	11.30	13.19	
13	Camp's Prolific	From S. U. Camp, Ouachita	1101 "	71.63	16.17	12.20	16.65	
14	Chamberlain's Prolific	From Mr. Chamberlin, Baton Rouge	848 "	74.65	17.12	8.22	11.32	White, Several ears on stalk.
15	Southern Prolific	From N. O.	1025 "	80.15	16.15	2.70	14.66	" " " "
16	White Normandy	From Department of Agriculture, Washington	1260 "	76.50	18.55	4.95	17.21	White Dent.
17	Mexican White Flint	From D. R. Calder, St. Mary	1579 "	73.80	16.14	10.06	20.81	White Flint.
18	Mexican and Creole	" " "	411 "	75.24	14.15	10.61	18.96	Yellow Flint.
19	Western Yellow	From Lucien Soniat, Jefferson	1327 "	76.52	17.40	6.08	18.13	Yellow Dent.
20	Golden Beauty	From Alexander Seed Company, Augusta, Ga.	596 "	73.85	20.30	5.85	7.86	

The Station will gladly furnish small quantities of seed of any of the above varieties upon application.

PLAT NO. XII.

Was devoted to sugar cane and sorghum. In the regular sorghum crop seven varieties were planted :

Early Amber Sorghum—Stalk small and heads light. Matures several weeks ahead of any other varieiy. Too small for much tonnage.

Early Orange—Medium stalk, heavy heads ; cures well into hay. Matures two to three weeks later than Early Amber. An excellent variety for forage.

New Orange—Similar in every respect to Early Orange.

White India—Very large stalk, heavy white seed heads. Matures much later than Amber. Cures well. Tonnage heavy Excellent for forage.

Link's Hybrid—Heavy heads. Very large stalks. Cures well. Matures with White India. Tonnage heavy. Excellent for forage.

Golden Rod—Large stringy heads. Stalk quite large and tall and red in color. Cures well. Tonnage large.

Minnesota Early Amber—Similar to Early Amber.

Kansas Orange—Similar to New Orange.

A careful chemical analysis was made of varieties in September and the tonnage and forage qualities tested. The readily cured blades are eaten with avidity by cattle, while the seed heads are excellent for both stock and poultry. The following per acre was obtained :

Early amber	7.39	tons.
Minnesota Early Amber	8.73	"
Early Orange	10.58	"
New Orange	10.66	"
Kansas Orange	13.94	"
White India	16.88	"
Link's Hybrid	15.70	"
Golden Rod	12.43	"

Besides these, 99 varieties were received from Sugar Experiment Station, Kenner, and planted April 19th. Quite a number of varieties failed to come up, having planted in many instances very few seeds. Those that did come and ripened before frost were carefully analyzed, with some very promising results, and seed carefully saved.

Besides the regular crop of purple sugar cane planted, the Sugar Experiment Station donated to this Station in March, 29 varieties of foreign grown canes. Sufficient seed has been obtained to make small planting the coming year. The canes grew nicely and promised well. The hardy Japonica cane is also grown and will probably do well in this latitude. The purple cane yielded 20.80 tons per acre, an excellent yield for this land.

ANALYSES OF SUGAR CANE.

During the season several samples of cane were sent to the station for analysis. The results are very satisfactory and encouraging to the production of sugar in North Louisiana. The following table gives analyses of Sugar cane :

Date	BY WHOM SENT	Total Solids	Per Cent Sucrose	Per Cent Glucose	Glucose Ratio	Co-efficient of Purity	Lbs Available Sugar Per Ton on 70 Per Cent Extraction
Oct. 19	Station	16 16	12 7	2 65	20 86	78 50	122
" 20	Station	15 1	12 8	2 57	20 08	79 50	125
" 29	Station	16 3	13	2 55	19 61	79 75	128
" 30	Station, Japanese Cane	17	12 9	3 01	23 33	75 29	117
" 31	M. A. Stamper, Lincoln Parish	15 6	12 6	2 27	18 01	80 76	128
" 31	J. M. White	16 1	12 3	2 14	17 39	81 45	127
" 31	Milton Hammons, Ouachita Parish	15 3	12 5	2 19	17 52	81 50	129
Nov. 10	Mr. Morris, Ouachita Parish, Stubble Cane	17 5	13 6	2 74	20 14	77 71	128
" 10	S. N. Camp " " "	17 6	13 8	2 22	16 08	78 40	146
" 10	" " " Plant Cane	16 6	23 2	2 35	16 6	79 51	135

The Station proposes making sugar next season. In view of that fact, as well as to try the experiment, nearly an acre of cane was planted in fall, a good quantity preserved in mat and all the stubble preserved. Thus far both stubble and plant are keeping nicely, stubble coming up and plant sprouting, and there is no doubt that the experiment will be successful. The people of North Louisiana are anxious to make their own sugar, and the Station to serve the people, is glad to be the pioneer in this new industry. Already North Louisiana practically makes her own syrup from sugar cane.

PLAT NO. 13

Was devoted to Forage crops. Bulletin No. 22 gives full description, history and feeding qualities of these plants.

The fodder is not inferior to corn fodder, nor are the seed heads much inferior, if at all, to Indian corn. They are eaten by all kinds of stock, including poultry. The Rural Branching sorghum, Millo Maize and Large African Millet are also adapted to silo purposes.

The following were planted: Pearl Millet, Teasinte, Large African Millet, Millo Maize, Rural Branching sorghum, Kaffir corn and Black Giant sunflower; the latter a magnificent chicken food. Besides these, Seradella, Lathyrus Sations, Lupins, Lathyrus Hirsutus, Winter Horse Bean, Soja Bean, (all belonging to the leguminosal family and closely related to the pea), and Mammoth Russian sunflower, were planted, but with poor results. Winter Horse Bean was a total failure. Soja Bean, though ranking high, as a forage plant, with some Western and Northern experiment stations, has failed every year to recommend itself here. The results of the present year, however, were better than previous years, and perhaps it may yet grow into popularity. It certainly has qualities to recommend it. The large leaf surface and upright stock, bearing pods in abundance, may yet place it high among forage plants. The other plants failed largely to come to a stand and those that did come were unsuccessful.

PLAT NO. 14.—SUNDRY CROPS.

There were planted in this plat three varieties of peanuts, chufas, and eleven of field peas.

Spanish Peanut—A desirable variety, early, a fine bearer, growth perfectly erect, not spreading on the ground like the common kinds of peanut, and therefore easily cultivated, the plow doing all the work. Also, in harvesting, all the peas hang to the root and can be rapidly gathered. Planted in April they ripen in August, and planted as late as July 1st to 10th, will mature full crops before frost. Therefore they are useful to follow after oats. The stems grow erect, are easily harvested for forage, making the richest quality of hay. The pea is smaller than the Virginia peanut, but very sweet, fills out well, makes no pods. Can be planted close in the row and in the drill, yielding largely per acre. Splendid to fatten hogs and children. The vine retains its greenness much longer than other varieties, suggesting its superiority for forage.

The present year, six large wagon loads were gathered from less than one quarter acre, supplying a large quantity of forage, hard to excel in nutritive and palatable value, all stock eating it with great relish.

Virginia Peanut—Vines large and growing flat on the ground, fruiting from tap root to extremity of vine. Fruit faulty; two to four nuts to pod. Pods large and colored light pink. Yield medium.

Georgia Red Peanut—Vines medium size, growing up from the ground and fruiting principally near the tap root. Pods faulty; three to four nuts each. Color red. Worthless pea.

COW PEAS.

Unfortunately, but little is known of the botany of this genus of plants, which has been erroneously styled a pea. It is really a bean, "Dolichos," but the species under this genus have never been fully determined. Of varieties we have a great number, presenting differences in habits of growth and maturing, and giving seed of every size and quality, and of every shade of color from the purest white to the deepest black. This

crop is highly prized for fertilizing purposes among the sugar planters of South Louisiana, but elsewhere throughout the South it does not receive one-half the attention which its valuable properties should merit. In time it is hoped that both its botany and its economical position in Southern agriculture will be both fully understood.

The following varieties were this year grown :

"Pea of the Backwoods, or the Old Man's Friend—This pea was brought to notice two years ago by the letters of Mr. Edward Fonville, of Onslow county, N. C., in the *Southern Cultivator*. It was recommended as the earliest bunch pea, and excellent for table use. It has so proved, two weeks ahead of any other, a larger bearer, and as a shell pea for table use, tender, marrowy and palatable. Are ripe for table use just six weeks after planting. It is a bunch pea strictly, therefore affording not much vine. The seed are small, cream colored, slightly 'pied.' Very prolific."

At Calhoun it matured in forty days.

"The Unknown Pea—Is a greenish white color, with white eye, full size, makes much vine, vigorous growth, large bearer. Pods long and very full, and in favorable seasons continues to make or bear fruit during several weeks. It is a very fine pea, worthy to come into general use. The Boss Pea advertised last year proved to be identical with the Unknown."

At Calhoun it was very late bearing, but gave heavy yield of peas and an exceedingly heavy foliage.

Dwarf Whippoorwill Pea.—A bunch pea, with but little vines. Begins fruiting in fifty or sixty days. Berry speckled, pods long and full, yield good.

Clay Pea.—Vines and foliage medium. Begins fruiting in seventy-five days. Yield good. Berry cream colored with white eye, medium in size. Pod of medium length and not crowded, keeps well.

Lady Pea.—A small white pea, white eye, with considerable vine of medium foliage. Begins fruiting in ninety days from time of planting.

White Prolific Pea.—White pea with black eye, vines large, foliage heavy, yield of peas good. Bears in eighty to ninety days. Berry large and closely resembling the next variety. A good table pea.

Large White Pea.—Vines and foliage heavy, very late fruiting. A large white pea, black eye, and very prolific. Bears in ninety days.

Indian Pea.—A large "liver and white pied" pea, with long and crowded pods. Very prolific. Vines and foliage heavy. Begins fruiting in sixty to ninety days. Berry soft and does not keep well.

King's Pea.—A large black and white pied pea. Large and crowded pod. Vines and foliage heavy. Very prolific. Begins fruiting in sixty to seventy days. Berry too soft to keep well.

Blue Pea—A small blue bunch pea. An excellent bearer and early, maturing peas from fifty to sixty days after planting.

Chufas—Were a splendid success, giving a large yield, suggesting and proving themselves to be a splendid crop for hogs.

The station has preserved seed of all the above varieties and can supply farmers small quantities of any variety.

In Plat 15 was a small plat of sweet potatoes. Two varieties were used, Yellow Yams and Jersey Sweets. Potatoes were set out June 4th, on freshly prepared land, rows 3½ feet wide by 18 inches in drill.

The following are the results:

No. Exp't	Kind and quantity of manure used per acre.	Variety.	Yield per Acre in pounds.
1	200 lbs. Cotton seed meal, 105 lbs. Sulphate potash 60 lbs Acid phosphate	Yams	3160 lbs
2	300 lbs. Cotton seed meal, 240 lbs Cotton seed hull ashes 60 lbs. Acid phosphate.	Jersey Sweets	7100 lbs
3	300 lbs. Cotton seed meal	Jersey Sweets	2780 lbs
4	240 lbs. Cotton seed hull ashes	Yams	3180 lbs
5	300 lbs. Phosphate	Jersey Sweets	11720 lbs
6	No manure	Jersey Sweets	9160 lbs
7	300 lbs. Cotton seed meal. 105 lbs. sulphate potash	Mixed	11000 lbs
8	300 lbs. Cotton seed meal, 240 lbs. cotton seed hull ashes	Mixed	8900 lbs

The Jersey Sweets are a new potato in this country. They

are yellow skin and meat, very dry and meally, sweet and well flavored. The potato is rather small, but good bearer. They are quite popular in Northern markets. The prolonged drouth of mid summer and early fall decreased the yield in large measure.

PLAT NO. 16—RICE.

Rice was planted April 12th, in drills on well prepared land. Below are the results :

PLAT NO. 16—RICE EXPERIMENTS.

No. Experiment	Kind and Quantity of Manure Used Per Acre.	Pounds of Rice Per Acre	Pounds Straw Per Acre
1	300 lbs Cotton seed meal	770	1890
2	150 lbs Acid phosphate	805	1890
3	50 lbs Kainite	1120	2065
4	300 lbs Cotton send meal, 150 lbs Acid phosphate	1120	2240
5	100 Acid phosphate 50 lbs Kainite	1050	1680
6	300 lbs Cotton seed meal, 75 lbs Kainite	1312	2388
7	300 lbs Cotton seed meal, 150 lbs Acid phosphate, 75 Kainite	1085	1995
8	No Manure	1015	2065

These experiments are not absolutely correct. In handling some grain was unavoidably wasted.

PLAT NO. 17.

This plat was devoted to watermelons, planted April 5th, 1889. Bedded rows with one horse Avery plow, 8 by 20 feet ; dug hole 18 inches square by 18 inches deep and put in holes 1 peck of compost to the hill, mixing well with soil, leaving 3 inches of soil on top.

They were plowed May 21st with short shovel and heel scrape, and hoed them once.

Experiment No. 1—"Pride of Georgia."—A round melon with green rind and Spanish seed, flesh red tender, and exceedingly sweet and highly flavored—a little late.

Experiment No. 2—"T. J. Bird."—Named for our Commissioner of Agriculture, Major T. J. Bird—A round melon and sometimes a little oblong, green rind with Spanish seed, red flesh,

very tender, exceedingly sweet and a delicious flavor. Will grow to weigh 50 pounds, doubtless originated from the "Pride of Georgia." These two varieties excel all others.

Experiment No. 3—"Kalb's Gem."—A round melon with rind of light and dark green stripes, black seed, red flesh, very firm or tough, thick rind, good flavor, large size.

Experiment No. 4—"Burpe's Iron Clad."—An oblong melon with light rattlesnake rind, light red flesh that is soft and not particularly sweet—grows extremely large.

Experiment No. 5—"Ice Cream." A small melon but of excellent quality, rind of two colors, green—inclined toward grey, small white seed, crimson flesh, sweet and tender.

Experiment No. 6—"Seminole."—Thin gray rind, flesh red and firm with red seed, medium size and of poor quality.

Experiment No. 7—"Rattlesnake."—Oblong shape with rattlesnake rind, quite thin, flesh red, tender and moderately sweet, Spanish seed; quality medium.

Experiment No. 8—"Jackson New."—Oblong shape with thin green rind, inclined toward gray, flesh red and tender, not sweet, small white seed; early variety, size medium; quality, poor.

Experiment No. 9—"Jones."—A round melon with dark, green rind, red flesh, tender and well flavored, early variety, growing large; Spanish seed; quality, very good.

Experiment No. 10—"Augusta Sugar Loaf."—Gray rind, red flesh, tender and sweet, thin rind, Spanish seed; quality, medium.

Experiment No. 11—"Cuban Queen."—A round melon of medium size, rattlesnake rind, flesh red and firm, heart decidedly tough, thick rind, black seed, keeps well; quality, poor.

Experiment No. 12—"Georgia Scaly Bark."—An oblong melon with green rind, having a scaly appearance, red meat and seed; quality, very poor.

IRISH POTATOES.—(SOLAMUN'S TUBEROSUM.)

Experiments in potatoes were of three kinds: First, experiments in varieties, object, to test the variety or varieties best

adapted to this soil and climate. Second, physiological experiments, object, to test size of potatoes and cuttings best to plant. Third, experiments in fertilizers, object, to test the fertilizer best suited to potatoes in this soil.

VARIETIES.

A small plat, situated on a gently sloping, well drained, hill side, was selected in the garden for experiments in varieties.

The land is poor, impoverished, devoid of vegetable matter and almost entirely denuded of surface soil.

Early in February cotton seed hulls were scattered broadcast over the plat, and land deeply broken broadcast with two-horse Avery plow, at time of planting, February 22nd, rows three feet wide were laid off with Diamond scooter. Three rows were devoted to each variety.

The potatoes were cut into large pieces, with from two to four eyes. They were fertilized with crushed cotton seed, at rate of sixty bushels per acre, and at rate per acre of 2000 pounds of following mixture: 1000 pounds cotton seed meal, 600 pounds Germain kainite, 400 pounds acid phosphate.

The fertilizer was applied in the opened scooter furrow, and then "listed" on with one-horse Avery plow, flat list. The list was then opened, potatoes planted, eight inches apart, and covered with two furrows of a diamond scooter plow, planting done February 22nd. The soil was in loose, pulverable condition.

The cold nature of light sandy soil retarded germination somewhat. Excepting a slight drouth in May, the seasons were all that could be wished. On April 12th the potatoes were "off-barred" with Diamond scooter and the middles burst out to them. No other cultivation whatsoever was given them.

The crop was harvested June 28th, carefully assorted, the merchantable from the non-merchantable, (smaller than pullet eggs), and each crop accurately weighed.

Below is a tabulated statement, giving the yield per acre of both merchantable and non-merchantable potatoes:

YIELD PER ACRE OF VARIETIES OF POTATOES HARVESTED JUNE 28TH, 1889.

Name of variety	Merchantable, No. Bushels	Non-Merchantable, or culls, No. Bushels.	Total yield per acre, No. Bushels.	About when ripe.
Early Rose	148 1-6	48 5-12	196 7-12	June 3rd
Boston Peerless	197 1-6	71 3-4	268 11-12	June 8th
Beauty of Hebron	162 1-6	58 1-3	220 1-2	June 8th
Rural Blush	179 2-3	39 2-3	219 1-3	June 12th
Thorburn	83 5-12	46 2-3	130 1-12	June 12th
Extra Early Vermont	130 19-20	41 1-30	174 59-60	June 15th
Russett	140	39 1-12	179 1-12	June 20th
Burbank	153 5-12	81 2-3	235 1-12	June 20th

EXPERIMENTS IN FERTILIZERS.

As stated above, the object of these experiments was to test the value of fertilizers, and to determine that fertilizer best suited to a maximum production in this soil.

SOIL, LOCATION, PREPARATION, ETC.

The plat selected for these experiments is similar in location and in character to that of varieties. A crop of dead pea-vines was turned under with two horse Avery plow, early in February and left in this condition till time of planting.

Boston Peerless was the variety planted, cuttings of two or more eyes were used. The planting was done February 27.

Rows were laid off three feet apart, with straight shovel, and fertilizer applied. A flat list was then made on fertilizer, list opened, potatoes planted one foot apart, and covered with two furrows of a straight shovel. The land was loose and in good pulverable condition.

On April 12th, they were "off barred," and middles opened with half-shovel. This was absolutely the only cultivation the potatoes received. Each experiment embraced five rows.

Below is a tabulated statement, showing number of experiment, the fertilizer used, and the yield of merchantable and non-merchantable potatoes per acre.

YIELD PER ACRE OF POTATOES, EXPERIMENTS IN FERTILIZERS, HARVESTED JUNE 25TH AND 26TH, 1889.

No. Experim'nt	FERTILIZERS USED	Merchantable No. of Bushels	Non-Merchant. No. of Bushels	Total Yield No. of Bushels
1	3 lbs Nitrate Soda 2 lbs Sulphate Ammonia 6 lbs Cotton Seed Meal 5 lbs Acid Phosphate 4 lbs Kainite	212 1-10	39 1-10	251 1-5
2	3 lbs Nitrate Soda 2 lbs Sulphate Ammonia 6 lbs Cotton Seed Meal 5 lbs Acid Phosphate	210 1-3	23 4-5	234 2-15
3	No Manure	52 1-2	9 14-15	62 13-30
4	3 lbs Nitrate Soda 2 lbs Sulphate Ammonia 6 lbs Cotton Seed Meal	150 9-60	34 3-20	184 3-10
5	5 lbs Acid Phosphate	57 2-3	14 1-2	81 9-10
6	18 lbs Cotton Seed Meal 5 lbs Acid Phosphate 4 lbs Kainite	227 19-60	31 2-3	259
7	18 lbs Cotton Seed Meal 4 lbs Acid Phosphate	192 19-60	30 1-10	222 5-12
8	No Manure	62 3-10	18 1-3	80 19-30
9	18 lbs Cotton Seed Meal	154	31 19-60	185 19-60
10	4 lbs Kainite	94 2-3	32 1-5	126 13-15
11	60 lbs Crushed Cotton Seed 4 lbs Kainite 5 lbs Acid Phosphate	232 8-15	42 1-2	275 11-30
12	60 lbs Crushed Cotton Seed 5 lbs Acid Phosphate	173 3-10	37 4-15	211 3-5
13	No Manure	34 7-15	51 14-15	86 2-5
14	60 lbs Crushed Cotton Seed	84	48 3-10	132 3-10
15	60 lbs Crushed Cotton Seed 4 lbs Kainite	67 1-3	67 43-60	135 1-20
16	60 lbs Green Cotton Seed 5 lbs Acid Phosphate 4 lbs Kainite	160 7-60	48 49-60	208 14-15

CONTINUED.

No. Experim'nt	FERTILIZERS USED.	Merchantable No. of Bushels	Non. Merchant. No. of Bushels	Total Yield No. of Bushels
17	{ 60 lbs Green Cotton Seed 5 lbs Acid Phosphate }	121 4-5	64 2-3	186 7-15
18	No Manure	23 4-15	43 1-20	66 19-60
19	60 lbs Green Cotton Seed	121 4-5	42	163 4 5
20	{ 60 lbs Green Cotton Seed 4 lbs Kainite }	115 2-3	56 7-20	172 1-60
21	{ 100 lbs Compost 4 lbs German Kainite }	149 4-5	48 49-60	198 37-60
22	100 Compost	88 1-3	70 7-10	159 1-30
23	No Manure	22 3-4	47 57-60	70 7-10
24	75 lbs Compost	109 7-20	47 3-5	157 1-10
25	{ Hog Hair 5 lbs Acid Phosphate 4 lbs German Kainite }	83 3-10	40 2-3	123 29-31

Very little rot was found in potatoes. The skin was comparatively smooth, except where crushed and green cotton seed and hog hair were used, then they were found to be a little scaly and rough. There also seemed to be a little more rot found in these cases than in others. It will be observed that, wherever nitrogen was employed, no matter in what form, a green, healthy and luxuriant growth was the result, as well as a good yield. It will also be observed that acid phosphate and kainite produced a smaller growth of vine, less luxuriant and smaller yield. The best results are found where they were used, together or singly, with some form of nitrogen. The best yield 275⅓ bushels, being found in experiment No. 11, where 60 pounds of crushed cotton seed was used with four pounds kainite and five pounds acid phosphate. Hog hair seems to have been of little, if any, manurial value whatever.

PHYSIOLOGICAL EXPERIMENTS.

The object of these experiments, as stated above, was to test

first the size of potato most preferable to plant, using large and medium potato; then the cuttings, using those with two or more eyes and then with one eye.

The seeds used, were the varieties above. In each row there were planted eight large potatoes, (a), eight medium potatoes, (b), eight pieces cut in usual manner, with two or more eyes, (c), and eight pieces with only one eye (d), all planted one foot apart.

Below is a diagram showing weight of potatoes and cuttings used, "a," weight of eight large potatoes, "b," weight of eight medium potatoes, "c," weight of eight cuttings with two or more eyes, "d," weight of eight cuttings, with one eye:

Name of variety	a.	b.	c.	d.
Early Rose	2 13-24 lbs	1 13-24 lbs	11-24 lb	1-6 lb
Boston Peerless	5 1-3 lbs	1 2-3 lbs	17-24 lb	15-48 lb
Beauty of Hebron	2 13-16 lbs	1 7-16 lbs	1-2 lb	5-16 lb
Rural Blush	2 5-12 lbs	1 1-3 lbs	3-8 lb	1-6 lb
Thorburn	2 7-24 lbs	23-24 lb	5-8 lb	5-16 lb
Extra Early Vermont	3 1-8 lbs	1 1-2 lbs	7-16 lb	1-4 lb
Russett	2 1-4 lbs	1 3-8 lbs	5-16 lb	1-4 lb
Burbank	2 19-24 lbs	1 1-16 lbs	1-2 lb	1-6 lb

Tabulated statement, giving results of yield per acre of foregoing physiological experiments:

"a," eight large potatoes, "b," eight medium potatoes, "c," eight cuttings, two or more eyes, "d," eight cuttings. one eye:

[See tabulated statement on next page.]

YIELD PER ACRE OF FOREGOING PHYSIOLOGICAL EXPERIMENTS.

Name of Variety	"a," Number Bushels		Total	"b," Number Bushels		Total	"c," Number Bushels		Total	"d," Number Bushels		Total
	Merchantable.	Non-Merchantable.		Merchantable.	Non-Merchantable		Merchantable	Non-Merchantable		Merchantable	Non-Merchantable	
Early Rose......	94 1-2	66 1-2	161	94 1-2	50 3-4	145 1-4	91	31 1-2	122 1-2	52 1-2	24 1-2	77
Boston Peerless.	192 1-2	57 3-4	250 1-4	105	64 3-4	160 3-4	61 1-4	61 1-4	122 1-2	45 1-2	22 3-4	68 1-4
Beauty of Hebron	119	136 1-2	255 1-2	85 3-4	85 5 6	171 7-12	77	33 1-4	110 1-4	43 3-4	17 1-2	61 1-4
§Rural Blush...	140	77	217	154	49	203	99 3-4	68 1-4	168	50 3-4	24 1-2	75 1-4
*Thorburn......	77	113 3-4	190 3-4	49	68 1-4	117 1-4	35	42	77	36 3-4	22 3-4	59 1-2
Ex. Early Verm't	87 1-2	96 1-4	183 3-4	61 1-4	80 1-2	141 3-4	124 1-2	43 3-4	168	38	28 1-2	62 1-2
†Russett	98	66 1-2	164 1-2	131 1-4	56	187 1-4	77	17 1 2	94 1-2	50 3 4	12 1-4	63
‡Burbank	157 1-2	129 1-2	287	85 3-4	61 3-4	147 1-2	101 1-2	22 3 4	124 1-4	47 1-4	29 3-4	77

*Hill missing, †vines green when dug, §original whole seed potato sprouting, ‡at time of digging, good‡keeper.

SECOND CROP OF POTATOES.

On July 31st a good large plat of Irish potatoes was planted, using the large and medium potato, fertilized with four parts cotton seed meal, one part acid phosphate and one part of potash, at rates of fourteen pounds per acre. The object was principally to raise potatoes for fall market. But the long continued drouth of summer and early fall interfered. Only one rain fell on crop during the time and that was before they came up, and even a very poor stand was obtained, in some instances not a third of a stand.

But of those that did come, it was remarkable to see the fine, large potatoes raised. And how they made without rain is a wonder, yet several barrels have been packed in sand and will be planted in early spring. Thus far they are keeping well, and the station will be able to put seed potatoes on the spring market. The following varieties have been preserved: Boston Peerless, Vermont Early Rose, Beauty of Hebron, Rural Blush, Burbank, Extra Early Vermont, Russet and Thorburn. Besides these varieties, the station received from the State Experiment Station, Baton Rouge, 120 varieties.

They were carefully planted and results of germination watched. Only a few hills of each variety were planted. The dry weather prevented many from coming up. Those that did, have been harvested and carefully preserved in sacks, packed in sand.

In the spring a larger planting will be made, and all varieties tested, and reported on. The object of this fall planting was to preserve seed. That done, the results of varieties will be eagerly watched next spring.

BULLETIN No. 28.

REPORT

OF THE

SUGAR EXPERIMENT STATION,

OF THE

LOUISIANA STATE UNIVERSITY AND A. & M. COLLEGE,

AT

AUDUBON PARK, NEW ORLEANS, LA.

WM. C. STUBBS, PH. D., Director.

ISSUED BY THE BUREAU OF AGRICULTURE,
T. J. BIRD, Commissioner.

PRINTED AT THE TRUTH BOOK AND JOB OFFICE,
BATON ROUGE, LA,
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THE AGRICULTURAL EXPERIMENT STATION,

LA. STATE UNIVERSITY AND A. & M. COLLEGE.

BUREAU OF AGRICULTURE.

GOV. F. T. NICHOLLS, President.

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D. N. BARROW, B. S., Assistant Director, Baton Rouge.

J. G. LEE, B. S., Assistant Director, Calhoun.

Assistant Director, Audubon Park.

B. B. ROSS, M. S., Chemist.

M. BIRD, B. S., Assistant Chemist.

A. T. PRESCOTT, M. A., Botanist,

H. A. MORGAN, M. S. Entomologist and Horticulturist.

W. H. DALRYMPLE, M. R. C.V. S., Veterinary Surgeon.

A. M. GARDNER, B. S,, Farm Manager Audubon Park.

J. E. PRATT, Farm Manager, Baton Rouge.

L. M. CALHOUN, Farm Manager, Calhoun.

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The bulletins and reports will be sent free of charge to all farmers, by applying to Major T. J. Bird, Commissioner of Agricultnre, Baton Rouge, La.

EXPERIMENT STATION,
AUDUBON PARK, New Orleans, La.

Major T. J. Bird, Commissioner of Agriculture, Baton Rouge, La.:

Dear Sir—I hand you herewith Field Experiments with Sugar Cane, and ask that it be published as Bulletin No. 28.

Respectfully submitted,

WM. C. STUBBS,
Director.

FIELD EXPERIMENTS.

With the end of the present season closes a series of experiments begun four years ago. It was contemplated in the beginning to extend them through five years, but the removal of this station from its old location near Kenner, to its new domicile at this place, has shortened the time.

These four years have been patiently spent in repeating the same experiments upon the same soil, and the aggregate results are far more suggestive and conclusive than those reached in one year. The bulletin will contain, therefore, a summary of the results of the four years, together with the detailed results of 1889. In comparing the yearly results, the different seasons must be known and considered. The station has kept an accurate weather record and diary ever since March 1, 1886. The following is a condensed record of each year's rainfall and temperature.

Condensed Weather Record of Sugar Experiment Station from March 1, 1886, to January 1, 1890.

Month.	Average Temp. Deg.	Maximum Temp. Deg.	Minimum Temp. Deg.	Rainfall Inches.
1886.				
March	63	80	37	9 13
April	69	87	41	7 32
May	76	93	57	3 59
June	83	97	69	11 5
July	83	95	68	3 25
August	84	96	66	4 18
September	80	91	59	5 24
October	73	87	39	1
November	66	75	33	5 55
December	65	79	26	2 75
1887.				
January	57	82	22	3 31
February	65 4	80	30	5 23
March	58 2	81	40	3 27
April	71 7	89	57	2 21
May	78	94	59	6 56
June	84	94	62	10 35
July	84	97	68	7 86
August	82 5	95	69	6 7
September	79	92	56	3 3
October	69 5	86	40	6 39
November	60	80	30	11
December	54 6	77	30	7 14
1888.				
January	56 6	77	30	3 77
February	59 8	76	37	9 8
March	59	78	36	5 79
April	73 4	85	54	91
May	76 7	92	54	11 77
June	79 8	92	65	8 69
July	82	98	71	5 49
August	81 2	95	70	15 8
September	77 3	89	57	3 29
October	70 6	85	53	3 4
November	62 4	84	34	2 5
December	63 6	71	27	4 12

[Continued on page 3.]

[Continued from page 2.]

Months.	Average Temp. Deg.	Maximum Temp. Deg.	Minimum Temp. Deg.	Rainfall Inches.
1889.				
January	54 .	71	34	8 3
February	55	75	31	3 21
March	63 6	79	40	2 38
April	72	86	47	3 28
May	78 1	91	48	76
June	82 3	96	57	9 43
July	85 6	92	68	7 15
August	81	90	66	5 74
September	79 1	91	51	5 3
October	68 1	86	51	----
November	58 9	82	30	----
December	63	80	45	43

In the following table is presented the four years in a comparative form, and it may be useful in determining some of the factors which go toward solving the problem of good crop years.

The winter of 1886 was very severe, destroying much of the seed and stubble, the spring was late and cold, and good stands of cane were not obtained till May. The subsequent seasons were fair, and where good stands prevailed the crop was medium.

The winter of 1887 was mild and conducive to excellent seed cane, the spring was moderately dry and warm; followed by a warm and wet summer grading into a cool dry autumn; conditions favorable to heavy tonnage.

The winter of 1888 was fairly propitious, but the spring was excessively wet, preventing the proper cultivation of the cane. The wet weather extended to July, causing a serious postponement or abandonment of the regular "lay-by" of cane. These rains were succeeded by a dry, cool fall, giving us light tonnage, but heavy sugar yield, due more to the low glocuse content than excess of sugar in cane.

The year 1889 will always be remembered as the year of drouth. The rainfall for the year was only forty-six inches, and this fell mostly in the winter and summer, giving us a spring and fall of unexampled dryness—a dryness which has been prolonged into the winter of 1890 and up to this time has scarcely been broken.

Taking the table and the seasons, we find that a dry, warm winter, followed by a moderately dry spring, and this, in turn, succeeded by a hot wet summer, shading gradually into a cool dry autumn are conditions favorable to a maximum growth of cane.

After the cane is laid by frequent showers of considerable intensity seem highly beneficial.

The following is the comparative weather statement for the four years.

	Aver. Temp.	Max. Temp.	Min. Temp.	Rainfall Inches.
	deg.	deg.	deg.	
1887	70 3	97	22	62 43
1888	69 3	98	27	75 33
1889	70 1	96	30	45 98
Spring months, 1886	69 3	93	37	20 04
Spring months, 1887	69 3	94	40	12 04
Spring months, 1888	69 7	92	36	18 47
Spring months, 1889	71 2	91	40	6 42
Summer months, 1886	83 3	97	66	18 93
Summer months, 1887	83 5	97	62	24 91
Summer months, 1888	81	98	65	29 98
Summer months, 1889	82 9	96	57	22 32
Fall months, 1886	73	87	33	11 79
Fall months, 1887	69 5	92	30	9 8
Fall months, 1888	70 1	89	35	9 19
Fall months, 1889	68 7	91	34	5 3
Winter months, 1887	59	82	22	15 68
Winter months, 1888	56 6	77	27	17 69
Winter months, 1889	57 3	82	31	11 94

THE FIELD EXPERIMENTS,

Extending over the four years, have been of the following :

1. Germination questions.
2. Physiological questions.
3. Varieties best adapted to Louisiana.
4. Manurial requirements.

GERMINATING QUESTIONS.

The sugar cane has been so long cultivated from cuttings that it has, like the banana, lost its power of producing ordinary true seed, even though it passes through all the phases of fructification. Often in nature, when any organ is rendered useless, it ceases to exist. The fish in underground caverns are eyeless. The banana and some other plants, long propagated from shoots or suckers, produce seedless fruits. In the last year or two, however, the cane has been made to produce true seed. The idea by which this result was achieved, was in itself a simple one, yet the thought may produce a revolution in cane culture. Profs. Harrison and Bovell, of Dodd's Reformatory, Barbadoes, conceived the idea that by placing in close proximity unlike varieties of cane from different parts of the world, by cross fertilization, perfect fructification might result.

Experiments have verified this conception, and to-day a large number of true seedlings are growing (some on this station from seed kindly furnished by Prof. Bovell,) and already several new varieties of great promise have been named and propagated. This discovery is of great value, since the cane plant, hitherto so refractory and susceptible to change only through bud variation, now become a pliant tool in the hands of the scientist, and soon we may expect varieties of great excellence as the result of the labors of the latter. Pending these researches and experiments, the Louisiana planters must continue to utilize a goodly part of each crop as seed, and economy often suggests the propriety of planting the upper part of the stalk, so poor in sugar, instead of the entire stalk, so valuable at the mill. This practice is, however, severely criticised by some, upon reasons drawn from known principles of vegetable physiology. The cane, say

they, has only sterile flowers, and consequently gives no seed or grains. Therefore the eyes of the cane are intended to replace the true seed or grain. In all seed bearing plants, those seed germinate and fructify best which are permitted to reach perfect maturity. Therefore, in imitation of this natural law, we must seek that part of the stalk which contains the largest and best developed eyes in order to secure seed which will produce the most vigorous plants. It is further claimed that where tops are universally used as seed a degeneracy of the cane will follow, since the latter is always reproduced with those parts of the cane where the juices are poorest in nourishment (sugar) and the eyes the most imperfectly developed. Hence, it is a practice with some of our planters never to plant fall cane until the polariscope shows at least 10 per cent. sugar in the cane. *Per contra* there are others who claim that the planting of the tops is justfiable from purely scientific reasons, besides the economy involved.

They regard the cane planted as "cuttings," rather than true seed, and the eyes as buds to be developed under proper conditions. They say that the florist when he wants to root new plants, never uses the old or mature wood, but rather the young and succulent portion. Therefore in planting cane the youngest and most succulent portions will secure the best results. Which is right has not yet been decided by science. Experiments in the field have demonstrated that eyes from both the mature and immature parts of the stalk will germinate. But which are the best, i. e., which will insure the best and surest results under the varying conditions of our seasons, soils, and rainfall?

To determine this question, the following experiments were instituted, with a view of continuing them through a series of years in order to eliminate as far as possible all the modifying factors incident to one year's experiment. Great pains were taken to select healthy stalks of uniform length. These were cut up into short pieces, beginning with the green immature top. Two eyes were left upon each cutting, and each stalk was selected so as to give eleven cuttings. Seventy-five of these cut-

tings, containing 150 eyes, were devoted to each experiment.

The land was in excellent order, having had a large crop of pea vines turned in early in the fall with a four-horse plow. The cuttings were carefully deposited in each row and covered by a hoe. The following are the experiments :

PLAT O.—GERMINATION QUESTIONS.

1. Seventy-five white immature joints of two eyes each.
2. Seventy-five joints next to No. 1, partially white, two eyes each.
3. Seventy-five joints next to No. 2, full red, two eyes each.
4. Seventy-five joints next to No. 3, full red, two eyes each.
5. Seventy-five joints next to No. 4, full red, two eyes each.
6. Seventy-five joints next to No. 5, full red, two eyes each.
7. Seventy-five joints next to No. 6, full red, two eyes each.
8. Seventy-five joints next to No. 7, full red, two eyes each.
9. Seventy-five joints next to No. 8, full red, two eyes each.
10. Seventy-five joints next to No. 9, full red, two eyes each.
11. Seventy-five joints, butts, two eyes each.

In 1886 the severe weather, with a late unfavorable spring, so prevented germination as to vitiate results. All germinated badly, but No. 3 gave the largest number of sprouts, followed closely by No. 2.

In 1887 a fresh planting was made, which was closely followed through three years.

In 1887 and 1888 this plat was worked up during November; in 1889, in October. This year was one remarkable for immature cane, particularly in the early part of the season. The following tables will show the yield and sugar contents for each year :

TABLE I—PLAT O—GERMINATION QUESTIONS.

Planting different parts of the Stalks of the Cane February 9, 1887.
First year Plant Cane harvested Nov. 3.

Part of the Stalk Planted.	No. of Stalks from 150 Eyes Planted, Counted.									Ton per Acre.	No. of Stalks per Acre.
	Feb. 27.	March 10.	March 13.	March 17.	March 19.	March 25.	At harvest Nov. 3.	Weight of Stalks. lbs.	Average Weight of each. lbs.		
1 Upper White joints........	5	24	24	24	26	34	97	247	2.54	18.14	14287
2 Next to White joints......	12	39	41	41	45	45	140	407	2.91	32.06	21050
3 Next to No. 2..............	10	45	48	54	63	69	165	485	2.94	38.18	25987
4 Next to No. 3..............	4	27	34	39	45	51	152	428	2.82	33.75	23940
5 Next to No. 4.....	1	27	36	45	51	53	154	442	2.87	34.8	24255
6 Next to No. 5..............	1	25	35	43	52	58	149	426	2.86	33.56	23467
7 Next to No. 6......	0	19	20	25	33	40	147	400	2.72	31.48	23152
8 Next to No. 7..............	0	13	18	23	27	32	133	320	2.41	25.24	20947
9 Next to No. 8..............	1	19	23	28	34	39	130	340	2.61	26.82	20552
10 Next to No. 9..............	0	12	14	20	26	36	97	214	2.21	16.88	15276
11 Butts *....................	0	11	15	20	41	41	73	160	2.19	12.62	11520

* This row was seriously injured in the summer by proximity to a fig tree, and is not counted in stubble.

TABLE 2—PLAT O—FIRST YEAR STUBBLE HARVESTED NOV. 14, 1888

Part of Stalks Planted.	No. of Stalks Harvested.	Weight of Stalks.	Average Weight of each.	Tons per Acre.	No. of Stalks per Acre.
		lbs.	lbs.		
1 Upper White joints..............	76	136	1.79	10.71	11970
2 Next to White joint...........	119	206	1.73	16.22	17742
3 Next to No. 2..........................	133	257	1.87	19 72	20947
4 Next to No. 3..........................	127	226	1.7	17.79	20002
5 Next to No. 4..........................	130	244	1.88	19.21	20475
6 Next to No. 5..........................	142	238	1.68	18.74	22305
7 Next to No. 6..........................	124	220	1.77	17.32	19536
8 Next to No. 7..........................	132	256	1.94	20.16	20790
9 Next to No. 8....	104	192	1.84	15.12	16380
10 Next to No. 9.......	89	146	1.64	11.49	14017

TABLE 3--PLAT O--SECOND YEAR STUBBLE HARVESTED OCT. 15, 1889

Part of the Stalk Planted.	No. of Stalks Harvested.	Weight of Stalks.	Average Weight of each.	Tons per Acre.	No. of Stalks Per Acre.
		lbs.	lbs.		
1 Upper white joints	60	78	1.3	6.16	9480
2 Next to white joints	90	167	1.72	13.19	14536
3 Next to No. 2	110	182	1.66	14.37	17380
4 Next to No. 3	125	257	2.06	20.3	19750
5 Next to No. 4	92	125	1.36	9.8	14536
6 Next to No. 5	112	246	2.2	19.41	18960
7 Next to No. 6	124	235	1.9	18.56	19592
8 Next to No. 7	123	214	1.74	16.9	19434
9 Next to No. 8	90	165	1.84	13.03	14220
10 Next to No. 9	64	114	1.78	9.	10112

TABLE 4—PLAT O—FIELD AND SUGAR HOUSE RESULTS, NOV. 3, 1887. FIRST YEAR PLANT.

Number and Kind of Experiments.	Yield per Acre in Tons.	Analyses.				Purity Coefficient.	Glucose Ratio.	Pounds of available sugar upon 70 per cent extraction.	
		Degree Baume	Total Solids.	Sucrose.	Glucose.			Per ton.	Per acre
1 Upper white joints	18.14	7.4	13.31	10.3	1.24	77.38	12.04	118	2141
2 Next to white joints.	32.06	7.8	14.01	11.2	1.35	79.94	12.05	128	4104
3 Next to No. 2	38.18	7 6	13.71	10.3	1.28	75.12	12.42	117	4467
4 Next to No. 3	33.75	7.3	13.21	10.	1.6	75.7	16.	99	3341
5 Next to No. 4	34.80	7.5	13.61	10.	1.6	73.47	16.	99	3445
6 Next to No. 5	33.56	7.8	14.01	10.9	1 35	77.80	12.38	124	4161
7 Next to No 6	31.48	7.3	13.11	10.5	1.28	80.09	12.19	120	3777
8 Next to No. 7	25.24	7.8	14.01	10.6	1.35	81.36	12.73	120	3029
9 Next to No. 8	26.82	8.	14.41	10.5	1.35	72.86	12.95	119	3192
10 Next to No. 9	16.88	7.9	14.31	11.5	1.35	80.36	11.73	133	2245

TABLE 5.—PLAT O—FIELD AND SUGAR HOUSE RESULTS—NOV. 14, 1888.—FIRST YEAR STUBBLE.

Number and Kind of Experiment.	Yield per acre, in tons.	Analyses.				Purity. Coefficient.	Glucose Ratio.	Pounds available sugar upon 70 per cent. extraction.	
		Degree Baume.	Total solids.	Sucrose.	Glucose.			Per ton.	Per acre.
1 Upper white joints..	10.71	8.4	15.2	13.5	89	88.81	6.59	170.1	1821.77
2 Next to white joints	16.22	8.2	14.8	13 3	75	89.86	5.63	169.75	2753.34
3 Next to No. 2........	19.72	8.4	15.1	13.5	77	89.4	5.7	172.27	3397.16
4 Next to No. 3......	17.79	8.4	15.2	13.7	80	90.13	5.84	175	3113.25
5 Next to No. 4......	19.21	8.3	14.9	13.5	82	90.6	6.07	171.78	3299.89
6 Next to No. 5......	18.74	8.6	15.5	14	69	90.32	4.92	181.51	3401.49
7 Next to No. 6........	17.32	8.3	15	13	82	86.66	6.3	164.78	2853.98
8 Next to No. 7........	20.16	8 1	14.6	12.7	87	86.98	6.85	159.53	3216.12
9 Next to No. 8........	15.12	7.5	13.6	11.4	89	83.82	7.8	140.91	2130.56
10 Next to No. 9......	11.49	7.8	14.1	12.3	91	87.23	7.39	153.09	1759

TABLE 6.—PLAT O.—FIELD AND SUGAR HOUSE RESULTS—OCT. 15, 1889.—SECOND YEAR STUBBLE.

Number and Kind of Experiment.	Yield per acre in tons.	Analyses.				Purity Coefficient.	Glucose Ratio.	Pounds available sugar upon 70per cent. extraction.	
		Degree Baume.	Total solids.	Sucrose.	Glucose.			Per ton	Per acre
1 Upper white joints	6.16	6 6	11.9	8.2	2.61	69	31.82	59.99	369.54
2 Next to white joints	13.19	6.7	12.2	8.2	2.67	67	32.56	58.66	773.72
3 Next to No. 2......	14.37	7.6	13.7	8.4	2.46	61	29.4	65.99	947.56
4 Next to No. 3......	20.3	7.6	13.8	10.8	2.41	78	22.31	100.66	2043.4
5 Next to No. 4......	9.88	7	12.7	9.6	2.37	75	24.68	84.7	836.84
6 Next to No· 5......	19.41	7	12.6	9.7	2.38	77	24.53	85.82	1665.76
7 Next to No. 6......	18.56	7.7	14	10.7	2.63	76	24.57	94.64	1756.52
8 Next to No. 7......	16.9	7	12.6	8.6	2.91	68	34.18	58.66	990.35
9 Next to No. 8......	13.03	6.5	11.7	7	3.23	59	46.14	30.24	394.03
10 Next to No. 9......	9	5.5	10	5.1	3.33	51	65.29	1.54	13.86

The following table will give the aggregate yield and the available sugar on 70 per cent. extraction per acre for the three years:

	Yield tons	Available sugar pounds.
1 Upper white joint	35.01	4332
2 Next to white joint	61.47	7631
3 Next to No. 2	72.27	8812
4 Next to No. 3	71.84	8497
5 Next to No. 4	63.89	7582
6 Next to No. 5	71.71	9228
7 Next to No. 6	67.36	8387
8 Next to No. 7	62.3	7235
9 Next to No. 8	55.67	5717
10 Next to No. 9	37.37	4018

CONCLUSIONS.

Here No. 3 has given the largest tonnage and next to No. 6 the largest available sugar. The upper white joints germinate much more quickly than the others, but these sprouts are incapable of withstanding prolonged droughts in early life. Many of these sprouts died in 1886, and the stubble crops were therefore "gappy." Again the stubble of No. 5 was somewhat injured in 1888 by driving carts over it to obtain cane from the experiments beyond, and, hence, its yield was very low in 1889.

These experiments clearly show that the upper portion of the cane, barring the green, immature joints, is the equal if not the superior of the whole cane, or any other portion for seed, and suggests the propriety of search for some practical way of utilizing the upper thirds of the entire crop for seed and grinding the other two-thirds.

HOW MANY STALKS OF CANE TO PLANT?

This question propounded to the plant cane in 1887, has been followed through the first and second rattoons.

Simultaneous with this question has been incidentally propounded another:

WHICH IS BEST FOR SEED—PLANT OR STUBBLE CANE?

In the same plat were also tried a few experiments comfirmatory of those already described. viz:

WHAT PART OF THE CANE IS BEST FOR SEED?

The following are the experiments in full:

1. One cane with a lap, cut in the row.
2. Two canes with a lap, cut in the row.
3. Three canes with a lap, cut in the row.
4. Four canes with a lap, cut in the row.
5. One cane, no lap, uncut.
6. Upper halves of canes, two and a lap.
7. Lower halves of cane, two and a lap.
8. Upper thirds of canes, two and a lap.
9. Middle thirds of canes, two and a lap.
10. Lower thirds of canes, two and a lap.

The results of three years are given in the following tables:

TABLE 7.—PLAT O—GERMINATION QUESTIONS—PLANTED FEB. 10, AND GATHERED NOV. 4, 1887. PLANT CANE.

Number and kind of Experiments	March 13. No. of Sprouts.		May 25. No. of Sprouts		Nov. 4. Plant.			Nov. 4. Stubble		
	Plant.	Stubble.	Plant.	Stubb	No of Stalks.	Weight of Stalks, lbs'	Ton per acre.	No. of Stalks,	Weight of Stalks, lbs.	Tons per acre.
1. One cane, (cut)..	36	50	89	77	371	1114	33.42	420	1109	33.27
2. Two cane, (cut)..	87	83	172	154	409	1232	36.96	413	1338	40.14
3. Three cane (cut)..	136	144	220	214	430	1144	34.32	440	1336	40 08
4. Four cane (cut)...	120	158	250	279	409	1296	38.88	479	1410	42.3
5. One cane (uncut)..	30	48	53	77	357	1146	34.33	413	1132	33.96*
6. Upper halves......	108	106	148	154	421	1360	40.8	436	1292	38.76
7. Lower halves......	53	57	123	109	388	1334	40.02	402	980	29.4 *
8. Upper thirds.......	139	101	168	147	420	1278	38.34	344	918	27.54*
9. Middle thirds......	100	109	165	180	385	1276	38.28	310	860	25.8 *
10. Lower thirds......	117	46	177	104	407	1134	34.02	296	740	22.2 *

*Injured more or less by shade of a live oak tree.

TABLE 8—PLAT O—FIRST YEAR STUBBLE, NOV. 14, 1888.

Number and Kind of Experiments.	Plant.			Stubble.		
	Number of Stalks.	Weight of Stalks.	Tons per Acre.	Number of Stalks.	Weight of Stalks.	Tons per Acre.
1. One cane (cut)................	315	516	15.48	355	668	20.04
2. Two canes (cut)...............	355	578	17.34	419	770	23.1
3. Three canes (cut).............	377	544	16.32	433	719	21.57
4. Four canes (cut)..............	433	691	20.73	461	866	25.98
5. One cane (uncut)..............	358	742	22.26	338	622	18.66
6. Upper halves..................	398	870	26.1	374	784	23.52
7. Lower halves..................	400	804	24.12	209	521	15.63*
8. Upper thirds..................	405	826	24.78	310	492	14.76*
9. Middle thirds.................	414	750	22.5	298	454	13.62*
10. Lower thirds.................	373	604	18.12	277	432	12.96*

TABLE 9.—PLATT O—SECOND YEAR STUBBLE, OCT. 15, 1889.

Number and Kind of Experiment.	Plant.			Stubble.		
	No. of Stalks.	Weight of Stalks.	Tons per Acre.	No. of Stalks.	Weight of Stalks.	Tons per Acre
		lbs.			lbs.	
1. One cane (cut)........................	275	572	17.16	307	767	23.01*
2. Two canes (cut).......................	278	533	15.19	217	451	13.54
3. Three canes (cut).....................	262	490	14.70	257	596	17.88
4. Four canes (cut)......................	334	855	25.65	368	868	26.05
5. One cane (uncut)......................	297	867	26.01	156	522	15.66
6. Upper halves..........................	321	674	20.22	241	520	15.61
7. Lower halves..........................	334	835	25.05	247	503	15.69
8. Upper thirds..........................	346	733	21.09	180	309	9.27
9. Middle thirds.........................	291	680	20.40	112	116	3.8
10. Lower thirds.........................	289	693	20.79	80	76	2.28

*Injured by shade.

TABLE 10—PLANT CANE, HARVESTED NOV. 4, 1887. PLAT O—GERMINATION QUESTIONS.

Number and Kind of Experiments.	Yield per acre, in tons	Analyses.				Coefficient purity.	Glocuse ratio.	Pounds of available sugar upon 70 per cent extraction.	
		Degree Baume.	Total solids.	Sucrose.	Glucose.			Per ton.	Per acre
1 one cane cut, plant...	33.42	7.05	12.71	9.9	1.77	77.89	17.86	101.5	3392
1 one cane cut, stubble	33.27	7.3	13.24	11.3	1.57	85.35	13.88	125.30	4169
2 two cane cut, plant..	36.96	7.4	13.39	10.2	1.84	76.17	18.03	104.16	3850
2 two cane cut, stubble	40.14	7.4	13.49	10.2	2.24	76.61	21.96	95.76	3844
3 three cane cut, plant.	34.32	7.3	13.19	10.1	1.92	76.57	19.	101.08	3469
3 three cane cut, stubble	40.08	7.5	13.69	10.3	1.9	75.23	18.44	104.82	4180
4 four cane cut, plant..	38.88	7.5	13.59	9.9	2.04	73.58	20.6	95.76	3723
4 four cane cut, stubble	42.3	7.5	13.59	10.9	1.9	80.2	17.43	112.7	4767
5 one cane uncut, plant	34.33	7.3	13.24	10.8	1.9	81.57	17.59	111.3	3821
5 one cane uncut, stubble	33.96	7.4	13.49	10.4	2.	77.83	19.23	103.6	3418
6 upper halves, plant..	40.8	7.3	13.24	10.8	1.9	81.57	17.59	111.3	4541
6 upper halves, stubble	38.76	7.5	13.69	10.2	2.	74.5	19.6	100.8	3907
7 lower halves, plant..	40.02	7.3	13.19	10.8	2.14	81.88	19.51	106.26	4253
7 lower halves, stubble	*29.4	7.4	13.49	10.3	2.	76.64	19.41	102.2	2004
8 upper thirds, plant..	38.34	7.3	13.14	10.4	1.9	79.9	18.26	105.7	4053
8 upper thirds, stubble	*27.54	7.6	13.89	10.6	2.	77.03	18.86	106.84	2930
9 middle thirds, plant..	38.28	7.4	13.44	10.5	1.9	78.12	18.09	109.1	4100
9 middle thirds, stubble	*25.8	7.6	13.89	10.5	2.	75.59	19.04	105.	2709
10 lower thirds plant....	34.02	7.6	12.74	10.	1.86	78.49	18.6	101.	3436
10 lower thirds, stubble.	*22.2	7.9	14.29	11.2	1.82	78.37	16.25	118.58	2521

*Injured by proximity of live oak.

Through an accident in the laboratory, the samples of juice were mixed, which vitiated the accuracy of results, and hence no correct table can be given for 1888. That for 1889 is, however, presented :

TABLE NO. 11—SECOND YEAR STUBBLE, HARVESTED OCT. 15, 1889. PLAT O—GERMINATION QUESTIONS.

Number and Kind of Experiments.	Yield per acres in tons	Analyses.				Coefficient of purity.	Glucose ratio.	Pounds of available sugar upon 70 per cent extraction.	
		Degree Baume.	Total solids.	Sucrose.	Glucose.			Per ton.	Per acre
1 one cane cut, plant...	17.16	7.4	13.3	10	2.27	75	22.7	92.33	1,584.38
1 one cane cut, stubble.	23.02	8.1	14.6	10.7	2.27	73	21.19	102.13	2,351.03
2 two cane cut, plant..	16.01	6.6	11.9	9.5	2.21	80	23.26	86.59	1,386.31
2 two cane cut, stubble	13.54	6.9	12.4	7.8	2.89	63	37.05	48.51	656.83
3 three cane cut, plant.	14.93	7.2	12.9	9.6	2.59	74	26.97	80.01	1,195.89
3 three cane cut, stubble	17.88	7.9	14.3	19.9	2.35	76	21.46	103.25	1,846.11
4 four cane cut, plant..	25.65	7.3	13.2	9.9	2.64	75	26.66	83.16	2,133.05
4 four cane cut, stubble	26.05	7.4	13.4	9.8	2.52	73	25.71	84.25	2,195.49
5 one cane uncut, plant	26.01	7.7	13.9	10.8	2.38	77	22.03	101.32	2,635.33
5 one cane uncut, stubble	15.65	7.6	13.8	10.4	2.64	75	25.38	90.16	1,411.90
6 upper halves plant...	20.22	7.8	14.	11.5	2.38	82	20.69	111.02	2,244.82
6 upper halves, stubble	15.61	8.	14 4	10.7	2.72	74	25.42	92.68	1,446.73
7 lower halves, plant...	25.65	7.5	13.5	10.7	[illegible].57	79	24.01	95.83	2,458.04
7 lower halves, stubble.	*15.11	7.9	14.2	11.	2.64	79	24.	98.56	1,488.24
8 upper thirds, plant...	22.	7.3	13.1	10.2	2.56	78	25.09	89.74	1,974.28
8 upper thirds, stubble	* 9.28	7.5	13.6	10.3	2.48	75	24.07	92.12	854.87
9 middle thirds, plant..	20.42	7.	12.7	9.4	2.48	74	26.38	79.52	1,623.8
9 middle thirds, stubble	* 3.49	7.4	13.4	10.2	2.5[illegible]	76	25.09	89.04	1,310.75
10 lower thirds, plant...	20.8	7.1	12.8	9.6	2.70	75	28.12	77.7	616.16
10 lower thirds, stubble..	* 2.3	7.3	13.1	8.7	2.95	66	33.93	61.95	142.48

*Injured by shade.

In the above experiments several of those where stubble cane was used as seed, were injured by shade. Eliminating these, we find that in an average year, with good seed, two stalks and a lap will be abundant seed; that stubble cane is as good, if not better seed, than plant and that the upper halves or thirds of the cane are as good as the entire stalk for seed. It is also shown that there is no physiological benefit accruing from cutting the cane. Whatever benefit may arise from this practice, now almost universal, must be ascribed to care and efficiency of work in planting and covering, and to the decreased risk of unearthing the cane during early cultivation, especially when the latter is very crooked. When cane has to remain in the ground all winter,

before germinating, it is best not to cut the cane at all if its physical condition will permit such a procedure, since every cut produces a wound which more or less induces fermentation and decay. It is the belief of those who practice cutting that when an eye on an entire stalks starts vigorously into growth, it can and may injure the vitality of the other eyes, and hence they recommend cutting the cane, to prevent this destruction. That such is not the case has been shown by a number of experiments conducted by the station. In planting entire stalks it is difficult to cover each eye at the same depth. Those near the surface germinate first, while those at the greatest depth may never germinate at all, though perfectly sound and healthy, because ere the conditions necessary to germination at that depth are secured the earlier sprouts are being cultivated and more dirt thrown on them. It frequently happens in digging stubble that eyes on the mother cane are found sound and, in many instances, germinate after a burial of over twelve months. With a view of throwing more light on this subject, the following experiments were instituted and carried to successful completion:

1. Two whole canes planted, tops three inches, butts six inches deep.
2. Two whole canes planted, tops three inches, butts ten inches deep.
3. Two whole canes planted, tops three inches, butts fourteen inches deep.
4. Two whole canes planted, tops three inches, butts sixteen inches deep.
5. Two whole canes planted, tops three inches, butts seventeen inches deep.
6. Two whole canes planted, tops, three inches, butts eighteen inches deep.
7. Two whole canes planted, tops three inches, butts twenty inches deep.
8. Two whole canes planted, tops three inches, butts twenty-one inches deep.
9. Two whole canes planted, tops three inches, butts twenty-two inches deep.

10. Two whole canes planted, tops three inches, butts twenty-four inches deep.

11. Two whole canes planted, tops eighteen inches, butts three inches deep.

12. Two whole canes planted, tops twenty-two inches, butts three inches deep.

13. Two whole canes planted, tops twenty-four inches, butts three inches deep-

14. One whole cane planted perpendicularly, top up, butt down.

Canes of about four feet in length were placed carefully in trenches properly prepared of above depth, on March 13, 1889.

On November 14th and 15th, they were carefully dug up, the growing canes removed and counted, the mother stalk carefully washed, and examined, and each eye carefully treated as regards germination and soundness. The following are the notes made:

Experiment No. 1. Both mother canes rotten, seventeen developed stalks, one stool coming from the eye deepest buried (six inches.)

Experiment No. 2. One mother cane rotten. The other perfectly sound with two well preserved sound eyes on it: there were twenty-four well developed stalks, one stool from eyes at depth of six inches, eight inches and ten inches, (lowest eye).

Experiment No. 3. Both mother canes sound, twenty-eight growing stalks; one stalk had a stool at fourteen inches depth, another at ten inches, and another at six inches, with one sound eye. The other stalk had its lowest four eyes started, but not yet to surface, with stools at ten inches, six inches. Every eye but one had germinated, this was dead and was at depth of near eight inches.

Experiment No. 4. Both mother canes rotten; only twelve stalks of cane. The lowest eye which germinated was at six inches.

Experiment No. 5. Both mother canes rotten, twenty-one stalks of cane, one stool from an eye twelve inches deep, one at eight inches, and another at six inches.

Experiment No. 6. Both mother canes rotten; thirteen stalks of cane, one stool of two stalks from an eye four inches deep and another from eye twelve inches, and at the lower end (eighteen inches) was found a living sucker not yet out of the ground, coming from a dead sprout, which had doubtless. been smothered in the spring.

Experiment No. 7. Both mother canes rotten; eleven stalks cane, one stool from eye fifteen inches deep, and another from eye fourteen inches deep.

Experiment No. 8. Both mother canes rotten, and no eyes germinated.

Experiment No. 9. One mother cane rotten, the other sound. No eyes germinated on rotten cane. Three stools from sound cane from upper eyes. Thirteen canes; three eyes still good.

Experiment No. 10. One mother cane rotten, and one excellently well preserved. Twenty-three canes. Only one stool of three stalks from rotten stalk, from second eye from top of cane (about five inches). Four stools had developed on sound cane, from twelve inches up to three inches deep. Five eyes had developed on lower part of cane into short sprouts, which had been smothered. Two eyes still good.

Experiment No. 11. Both mother canes sound; twenty canes; one stool from an eye twenty-four inches deep, was very curious in its underground connection with the mother stalk. It ran out at an angle of about 45 degrees to mother stalk to a length of seventeen inches, and then came perpendicularly to the surface. This forcibly illustrated the power of vitality. Three eyes on the two canes were still sound.

Experiment No. 12. Both mother canes rotten; thirteen canes from only two eyes, at eight and six inches deep.

Experiment No. 13. Both canes rotting; twelve canes from two eyes, ten to eight inches deep.

Experiment No 14. This cane was still sound. Every eye from eighteen inches deep to the top germinated, giving twenty-one fully developed canes. After being dug up the stalk with its adherent growth was a great curiosity. It had the form of an

umbrella inverted by the wind, only the ribs were placed at intervals along the stalk. At the depth of twenty-five inches there was found a sound eye. Below this the stalk was rotten, above sound and strong.

The sound eyes in every case were planted, and germination actually produced. It is to be regretted that the canes used in these experiments were defective. Our best seed had been planted before this work was projected, and in preparing for this work we had to select stalks from refused seed cane. However, enough is shown to controvert the opinion that an eye starting early into growth does destroy the other eyes on the same cane unfavorably situated. It also suggests the immense power resident in a good sound eye of cane. Last season was, however, a very dry one, and perhaps favorable to these experiments, while the seed used was defective and unfavorable. A wet season, with excellent seed cane, might give different results, especially upon stiff, undrained soil. Whenever a large number of stalks appeared above ground, the mother cane was nearly always sound.

Along with the above, another series of experiments was made. Canes were cut up into one and two joints and planted vertically at distances apart varying from six to eighteen inches. The land was nicely bedded, and the joints were simply inserted by hand. A drouth of unprecedented fury prevailed immediately after planting, with disastrous results to the experiments.

Row No. 1, where one joint was planted 12 inches apart, failed to germinate.

Row No. 2, where one joint was planted 18 inches apart, give one stool of fifteen stalks.

Row No. 3, where one joint was planted 6 inches apart, gave eight stools, aggregating seventy-nine stalks.

Row No. 4, where two joints were planted 12 inches apart, gave six stools, aggregating seventy-six stalks.

Row No. 5, where two joints were planted 18 inches apart, gave five stools, aggregating sixty-eight stalks.

Row No. 6, where two joints were planted 6 inches apart, gave seven stools, aggregating eighty-three stalks.

This cane came up very scatteringly and suckered enormously, giving very few well developed stalks.

PHYSIOLOGICAL EXPERIMENTS.

WHAT DISTANCE APART SHALL WE GIVE OUR CANE ROWS?

This question was experimentally begun with plant cane in 1888. This year it has been followed into stubble.

The following, taken from bulletin No. 20, gives an account of the original planting. This year the stubble has been treated in same manner as regards fertilizers, the latter applied on May 2. Some difficulty was experienced in working properly the narrow rows, and they suffered in consequence.

"1. Three rows, three feet wide.

"2. Three rows, four feet wide.

"3. Three rows, five feet wide.

"4. Three rows, six feet wide.

"5. Three rows, seven feet wide.

"6. Three rows, eight feet wide.

"These rows were two acres long, and were divided into equal parts. Upon the upper part, plant was used for seed; and on the lower, stubble. Each of these parts was again equally divided, and upon the southern half of each part manure was used, the same amount to each experiment. This gave each row the same amount of manure, but very varying quantities per acre. Bradley's fertilizer was used on the part planted with stubble, and Bowdker's fertilizer on that with plant. These goods were especially prepared in Boston, for Mr. Frank Ames, for his sugar plantation, and by him presented to the station.

"Two attempts were made, after the cane had reached several feet in height, to cultivate the narrow rows with a two horse plow, by driving the mules "tandem," but a failure was made each time. The soil was too stiff. The other experiments were cultivated like the rest of the cane on the station, in the usual way.

"The difficulty of cultivation must always remain as a serious objection to narrow rows for cane in stiff soils. In light soils a one horse plow may do all the work effectually. However, in these experiments our narrow rows do not show any loss from

lack of cultivation, nor from the absence of high ridges and deep middles, though the subsequent seasons were extremely unfavorable."

Results of both 1888 and 1889 are herewith given :

RESULTS OF PLAT 13—DIFFERENT WIDTHS OF ROWS IN PLANT CANE, FOR 1888.

Width of rows, feet.	Fertilizer used.	Amount Fertilized per acre.	Yield per acre in tons.	Analyses.				Purity coefficient.	Glucose Ratio.	Pounds of available sugar upon 70 per cent. extraction.	
				Degree Baume	Total solids.	Sucrose.	Glucose.			Per ton	Per acre
		Lbs.									
3	Bradley	1,336	39.38	9	16.2	14.1	.78	87.03	5.33	181.02	7,128.57
4	Bradley	1,002	38.55	8.4	15.1	12.5	1.15	82.78	9.12	150.9	6,748.25
5	Bradley	800	34.04	8.8	15.8	13.4	.97	84.81	7.23	167.3	5,694.89
6	Bradley	668	30.87	8.5	15.3	12.8	1.15	83.66	8.97	155.12	4,788.55
7	Bradley	573	29.69	8.4	15.2	12.7	1.08	83.55	8.5	155.12	4,605.51
8	Bradley	504	21.59	8.2	14.8	12 4	.97	83.78	7.82	153.3	3,177.91
3	No manure.......	.....	31.41	7.3	13.2	11.2	.75	84.09	6.75	141.12	4,432.58
4	No manure.......	.....	25.93	7.3	13.2	11.2	.75	84.09	6.75	141.12	3,659.24
5	No manure.......	.....	24.91	7.3	13.2	11.2	.75	84.09	6.75	141.12	3,515.3
6	No manure.......	.....	21.69	7.3	13.2	11.2	.75	84.09	9.7[illegible]	141.12	3,060.91
7	No manure.......	.....	24.69	7.3	13.2	11.2	.75	84.09	6.75	141.12	3,516.48
8	No manure.......	.....	20.65	7.3	13.2	11.2	.75	84.09	6.75	141.12	2,914.13
3	Bowdker's........	1,336	35.91	7.5	13.5	11.2	.86	82.96	7.67	138.79	4,982.15
4	Bowdker's........	1,002	31.44	7.8	14.	12.2	1.07	87.14	8.77	148.4	4,665.7
5	Bowdker's........	800	27.72	7.4	13.4	11.2	.8	83.58	7.67	138.74	3,845.87
6	Bowdker's........	667	21.29	7.9	14.2	11.9	1.06	83.8	8.90	144.34	3,023
7	Bowdker's........	573	21.91	6.7	12.	9.5	.87	79.16	9.15	114.8	2,515.27
8	Bowdker's........	504	18.4	7.8	14.	12.5	.96	89.28	7.68	154.84	2,849.06
3	No manure.......	.....	31.37	8.	14.4	13.	1.01	90.27	7.76	160.86	5,040.18
4	No manure.......	.....	23.53	7.5	13.6	11.9	.96	87.5	8.06	146.44	3,545.73
5	No manure..... .	.....	20.82	7.9	14.2	12.	.83	84 5	6.91	150.64	3,130.32
6	No manure.......	.....	16.22	8.2	14.8	12.7	.92	85.81	7.32	158.48	2,570.54
7	No manure.......	.....	17.1	8.	14.4	12.3	.86	85.41	6.99	154.14	2,635.79
8	No manure......	.....	19 75	8.4	15.1	12 9	.9	85.43	6.97	161.7	3.190.57

RESULTS OF PLAT 13—DIFFERENT WIDTHS OF ROWS IN STUBBLE CANE, 1889.

Width of rows, feet.	Fertilizer Used.	Amount Fertilizer per Acre. Lbs.	Yield per Acre in Tons	Analyses.				Coefficient of Purity.	Glucose Ratio.	Pounds available sugar upon 70 per cent. extraction.	
				Degree Baume.	Total Solids	Sucrose.	Glucose.			Per Ton.	Per Acre.
3	Bradley......	1,336	23.22	7.8	14.1	11.9	1.31	84	11.	139.09	3,231
4	Bradley......	1,002	19.74	7.8	14.1	12.1	1.11	85	9.17	146.16	2,885
5	Bradley......	800	21.76	7.8	14.1	12.	1.17	85	9.75	143.5	3,123
6	Bradley......	668	20.31	7.8	14.	11.9	1.13	85	9.49	142.94	2,903
7	Bradley......	573	20.17	8.	14.5	12.5	1.04	86	8.31	153.16	3,089
8	Bradley......	504	15.88	7.9	14.2	12.4	1.14	87	9.19	149.66	2,377
3	No manure..	.....	15.63	8.	14.5	12.3	1.06	84	8.61	149.94	2,343
4	No manure..	.....	10.82	8.	14.5	12.5	1.14	86	9.12	151.06	1,634
5	No manure..	.....	12.64	7.8	14.	12.	1.15	85	9.58	143.92	1,819
6	No manure..	.....	12.69	8.1	14.6	12.2	1.16	83	9.5	146.44	1,858
7	No manure..	.....	14.04	8.	14.5	12.1	1.22	83	10.08	143.78	2,018
8	No manure..	.....	15.12	8.	14.5	12.5	1.18	86	9.44	150.22	2,271
3	Bowdker's...	1,336	24.45	7.9	14.2	12.	1.03	84	8.58	146.44	3,580
4	Bowdker's...	1,002	20.09	7.9	14.3	12.1	1.06	84	8.76	147.14	2,956
5	Bowdker's...	800	17.2	7.9	14.2	12.	1.07	84	8.91	145.6	2,504
6	Bowdker's...	668	15.36	7.9	14.2	11.5	1.11	81	9.65	137.69	2,114
7	Bowdker's...	573	14.61	7.9	14.2	11.8	1.19	83	10.08	140.21	2,048
8	Bowdker's...	504	15.5	7.5	13.5	11.3	1.21	83	10.7	132.79	2,058
3	No manure..	.....	12.56	7.9	14.2	11.5	1.08	81	9.39	138.32	1,737
4	No manure..	.....	13.68	8.3	15.	13.	1.01	87	7.76	160.79	2,199
5	No manure..	.....	15.52	8.4	15.1	13.	1.02	86	7.84	160.58	2,492
6	No manure..	.....	15.2	8.	14.5	12.5	1.11	86	8.88	151.69	2,306
7	No manure..	.....	14.84	8.3	15.	12.6	1.19	84	9.44	151.41	2,247
8	No manure..	.....	13.76	8.3	15.	12.7	1.13	85	8.89	154.07	2,120

COMPARISON OF AGGREGATE RESULTS OF PLAT 13 FOR TWO YEARS.

	3 ft. rows.		4 ft. rows.		5 ft. rows.		6 ft. rows.		7 ft. rows.		8 ft. rows.	
	Tons,	Available sugar.	Tons.	Available sugar.	Tons.	Available sugar.	Tons.	Available sugar.	Tons.	Available sugar.	Tons.	Available sugar
		L bs.		L bs.		L bs.		L bs.		L bs.		L bs.
Bradley	62.61	10,360	58.29	9,633	55.8	8,828	51.18	7,692	49.86	7,695	37.47	5,555
No manure	47.04	6,776	36.75	5,293	37.55	5,334	34.38	4,919	38,73	5,534	35.77	5,185
Bowdker	60.36	8,562	51.53	7,622	44.92	6,350	36.65	5,137	36.52	4,563	33.9	4,951
No manure	43.93	6,777	37.21	5,745	36.34	5,622	31.42	4,877	31.94	4,883	33.51	5,311
Average	53.48	8,118	45.94	7,073	43.65	6,534	38.33	5,656	39.26	5,668	35.16	5,250
Excess of 3 feet rows over	....	......	7.54	1,045	9.83	1,584	15.15	2,462	14.23	2,450	18.32	2,868
Excess of 4 feet rows over	....	......	....	.....	2.29	539	7.61	1,417	6.68	1,405	10.78	1,823
Excess of 5 feet rows over	.....	......	.....	.....	.....	.....	5.32	878	4.39	876	8.49	1,284
Excess of 6 feet rows over	.....	......	.....	.....	.....	.....	.....	.....	.....	.....	3.17	406
Excess of 7 feet rows over	.....	......	....	.....	.....	.....	.....	.....	.....	.....	4.1	418

The sucrose content seems to depend upon factors other than width of rows, though the narrow rows have slightly the advantage. Attention was called in bulletin No. 20 to the defective drainage of the six foot plat, due to an old water furrow which once drained an oat patch. The decrease in yield due to this cause was also apparent this year.

To plant an acre in cane, with rows seven feet apart, using "two stalks and a lap" for seed, will require about four tons of cane; at the same rate there will be required for seed:

In three foot rows, nine and one-third tons per acre.

In four foot rows, seven tons per acre.

In five foot rows, 5.6 tons per acre.

In six foot rows, four and two-thirds tons per acre.

In seven foot rows, four tons per acre.

In eight foot rows, three and one half tons per acre.

Substracting these qualities from average yield above will give net cane per acre over the amount used in planting as follows:

Three foot rows, 44.15 tons.

Four foot rows. 38.94 tons.

Five foot rows, 38.05 tons.

Six foot rows, 33.67 tons.

Seven foot rows, 35.26.

Eight foot rows, 31.66.

These results are so striking that we can not avoid the conclusion reached last year.

It is unwise as well as unscientific to draw conclusions from a few years' experience, yet the above results strongly suggest thought and reflection. Have not in our efforts at easy and thorough cultivation passed the boundary of maximum yield sugar content in the width of our rows? Do not wide rows and late cultivation also tend to large immature canes at harvest? The frequent remarks of planters that "cane never grows well until laid by," and "cane never grows fast until it shades the ground," cause the inquiring mind to ask the reasons for these popular axioms. May not the frequent rupture of the roots in

cultivation, which wide rows permit to be extended (perhaps) beyond the requirements of the plane, and the growth of grass and weeds, which flourish longer (because unshaded) in wide rows (the killing of which often requires the late cultivation), have much to do with originating these popular beliefs?

It is certainly desirable in this climate to have early maturing cane. To do this obstacles or checks upon its growth must be presented in some form in order that it may do the only thing left it—i. e., mature. These obstacles may be found in want of drainage, or lack of fertility. The last obstacle may be presented by withholding fertilizers, absence of deep ploughing, want of rain and crowding the land with cane, etc. May not a witdh of rows just sufficient for good cultivation, varying according to soil, be better than the conventional seven foot row now almost everywhere found. The station continues to test this question.

VARIETIES OF CANE.

The station has now growing on it over sixty varieties of cane, collected from all parts of the world. It has received since our last report thirty-five varieties from the Botanical gardens of Jamaica, kindly donated by the director.

It has also received from Prof. Bovell, of Dodd's Reformatory, Barbadoes a bottle of true cane seeds. These have been carefully planted. Many have germinated, but have been rapidly destroyed by ants. Preventive measures have been now introduced, and it is hoped that canes may ultimately be obtained here from seed, as has been so successfully accomplished at Barbadoes. To both of the above mentioned gentlemen the station returns thanks.

Last year over thirty varieties of cane were grown to maturity, carefully analyzed, and in several instances worked up in the sugar house. Our results so far are somewhat contradictory. Several canes which did well in 1888, a wet season, almost failed in 1889, a very dry one, and *vice versa*. Again, several canes which were very promising the first year, have not fulfilled ex-

pectations in subsequent seasons, while others, entirely unpromising the first season, are gradually becoming acclimated and are growing in favor. No foreign cane has as yet attained that complete acclimation which will enable us to speak positively of its merits. It is, therefore, deemed best to withhold all remarks in regard to the different varieties until their merits and demerits have been more fully investigated.

One fact is here worthy of record; Every sample received is carefully examined and an accurate description as to its botanical and physical properties noted in a book kept for that purpose. On harvesting the cane the next season, another thorough examination is made and entered in its appropriate place From a record of such examinations, we find that many of these canes have either been changed greatly by planting here, or in their immature condition (only eight months old here), are quite different from the mature cane received. It is well known that many favorite varieties of cane are susceptible of variation in the same climate on different soils. Perhaps in a different climate and on a different soil variation may markedly occur. These thoughts have been suggested by receiving canes of marked similarity, and yet totally unlike, from different countries under different names. Have not the numerous socalled varieties originated by variations incident to climatic and soil influences, and can not a patient investigation eliminate a large number of the present varieties and reduce the number to a few primordial types, with numerous slight variations unworthy of being styled varieties? The station is now trying to collect and bring together under a common influence all the noted varieties of cane and to test the question of reduction of the number of true varieties. At an early day a bulletin covering the study already made of the numerous varieties now on the station will be issued.

Last April thirty varieties of cane were planted in adjacent rows in the hot room of agricultural hall. These came from all parts of the world, and were planted in close proximity, in order that by cross fertilization the fructifying power might be given to the seed. It is well known that all canes at a certain age go

through the process of "arrowing" or "tasselling," but usually produce no true seed. Profs. Harrison and Bovell have, by placing varieties of opposite character and habits in close juxtaposition, produced true seeds, which have germinated and given new varieties of cane. In humble imitation of their example, the station is now anxiously awaiting the tasselling of this cane, in hopes of obtaining true seed. As yet no sign of the arrow is visible, though the canes are immense and their sugar content has passed over 18 per cent, in several instances.

MANURIAL REQUIREMENTS.

For four years the station has made strenuous exertions to determine a fertilizer suitable for cane on the sugar lands of Louisiana. A fertilizer is desired which will give simultaneously large *tonnage* with large *sugar content*. Unfortunately, these combinations are rarely obtained in this latitude, where the cane is harvested long before maturity. So far that class of manures which will insure a large tonnage are known to give succulent watery canes, poor in sugar, while unmanured stunted canes are apt to be comparatively rich in saccharine. It is therefore, for the present at least, prudent to seek a fertilizer which will give a fair tonnage with chances in favor of high sucrose. The ingredients of value in every commercial fertilizer are nitrogen, phosphoric acid, and potash. These in different forms are combined in varying proportions to form the fertilizers offered on our market.

Do our soils need all three of these ingredients to make a remunerative harvest of cane? If so, in what forms shall they be presented, and in what proportions shall these combinations be made and what quantities of the mixtures shall be used per acre? To answer truly all these questions would be the solution of the chief agricultural problem to-day presented to our sugar planters. In experimenting to determine these questions, a seemingly insuperable difficulty confronts us. We are seeking *sugar*—a compound containing only *carbon and hydrogen*—without a trace of any of the above ingredients, and yet it is universally

known that well developed cane can not be obtained when the soil is deficient in any one of them. What then are their relations to the elaboration of sugar in the cane? Their action is not nutritous. It may be physiological, but exactly in what way is yet an undetermined problem. Do excesses of all or any one of these ingredients tend to develop sugar in the juice? Nitrogenous manures alone certainly do not, for when offered in excess, produce exceedingly poor canes in large quantities. Phosphatic manures may accomplish this end, yet there are seasons when they, too, utterly fail to augment the sugar content. Potassic manures in all forms have failed with us to effect the sugar content or tonnage in any way, though reported favorably as to the former in some foreign experiments. Experiments covering all of the above questions have been carefully and patiently made for four years, under the hopes that some light would be thrown upon this important problem. While the problem has been by no means solved, yet much valuable information has been gained, and we are enabled to report successful progress.

NITROGEN MANURES.

In 1886 a series of experiments were begun with the different forms of nitrogen, using nitrate of soda, sulphate of ammonia, cotton seed meal, fish scrap, and dried blood. All of these were used in such quantities as to give twenty-four, forty-eight, and seventy-two pounds of nitrogen per acre, styled one-third, two-thirds, and one full ration. The results of 1886 and 1887 clearly demonstrated that the full ration of seventy-two pounds per acre was excessive and wasteful, and hence, in subsequent years, only the one-third and two-thirds rations were used. The above forms were used with excesses of acid phosphate and potash.

At same time experiments with a mixture of these last two substances, called mixed minerals, were made to test their efficacy when used alone. In 1886 the stand was severely injured, and hence tonnage not secured; only analyses of canes obtained. Each subsequent year gave both. The following table gives the results for 1889:

RESULTS OF PART XIV—NITROGENOUS MANURES.—FIRST YEAR STUBBLE 1889, HARVESTED NOV. 15.

Names and Quantities of Fertilizers Used	Yield per acre, in tons.	Analyses.			Purity Coefficient.	Glucose Ratio.	Pounds available sugar upon 70 per ct. extration.	
		Total solids.	Sucrose.	Glucose.			Per ton.	Per Acre.
1 350 lbs Cotton Meal, 500 lbs Acid Phosphate, 70 lbs Mur'te Potash. Mixed Minerals	22.75	13.1	11.1	1.32	84	11.89	127.7	2905
2 700 lbs Cotton Meal and Mixed Minerals	24.85	13.2	11.1	1.28	84	11.53	128.5	3194
3 350 lbs Fish scrap and Mixed Minerals	19.09	14.3	11.8	1.08	83	9.15	142.5	2720
4 Mixed Minerals	14.03	14.5	12.2	1.04	84	8.52	146.2	2050
5 700 lbs Fish Scrap and Mixed Minerals	19.65	14.2	12.3	1.13	86	9.18	148.5	2917
6 180 lbs Dried Blood and Mixed Minerals	18.66	13.1	11.3	1.07	86	9.46	135.7	2533
7 360 lbs Dried Blood and Mixed Minerals	22.79	13.8	11.3	1.42	82	12.56	128.4	2926
8 120 lbs Sul Ammonia, Mixed Minerals	19.68	12.9	11.2	1.07	87	9.55	134.3	2640
9 240 lbs Sul. Ammonia, Mixed Minerals	22.70	13.9	11.1	1.38	79	12.43	126.4	2870
10 No Manure	12.81	12.8	10.7	1.23	83	11.49	123.9	1588
11 150 lbs Nitrate Soda and Mixed Minerals	17.05	13.9	12.0	1	86	8.33	147	2505
12 300 lbs Nitrate Soda and Mixed Minerals	12.51	13.6	11.4	1.11	84	9.73	136.3	2941

COMPARISON OF RESULTS.

AVERAGE YIELD PER ACRE OF..................	No Manure.		Mixed Minerals.	
	Tons.	Ave'ge sugar	Tons.	Ave'ge sugar
		lbs.		lbs.
⅓ cotton seed meal over........................	7.62	1,288	7.75	1,115
⅔ cotton seed meal over........................	9.20	1,345	9.33	1,172
⅓ fish scrap over..............................	5.48	....	5.61	....
⅔ fish scrap over..............................	6.40	1,231	6.56	1,056
⅓ dried blood over.............................	7.86	....	7.99	....
⅔ dried blood over.............................	8.82	1,175	8.95	1,002
⅓ sulphate ammonia over........................	6.29	1,203	6.42	1,024
⅔ sulphate ammonia over........................	9.78	1,225	9.91	1,052
⅓ nitrate soda over............................	7.53	967	7.16	694
⅔ nitrate soda over............................	7.41	647	7.54	174
Av. of all ⅓ rations over......................	6.85	1,150	6.98	944
Av. of all ⅔ rations over......................	8.33	1,124	8.46	951

CONCLUSIONS.

It is evident from the experiments of four years that these soils require nitrogen to grow maximum crops. This is clearly shown by the constant increase of the nitrogen mixtures over both "no manure" and "mixed minerals." Either of the above forms are readily assimilable by the cane plant, hence the planter can, with impunity, purchase that form which will give him the cheapest nitrogen.

The third question propounded by these experiments is not yet satisfactorily solved, viz: The quantity of nitrogen to be used per acre. The whole ration (seventy-two pounds per acre) is certainly excessive and wasteful. Whether the two-thirds ration (forty-eight pounds per acre) carries with it a profit over the one-third ration (twenty-four pounds per acre) is still doubtful. Though the tonnage is slightly enhanced, the sugar per acre is about the same, and future experiments must fully decide this question.

PHOSPHORIC ACID AND POTASH.

Experiments with the various forms and in different quantities of phosphoric acid and potash have been made, extending over three years, and the results have been published yearly. By

comparing these results, it will be seen that phosphoric acid *is needed* on these soils to grow maximum crops, though not in as great demand as nitrogen. It has also been shown that the soluble forms are the most profitable for cane.

No form of potash used in moderate quantities has been productive of apparent good. The carbonate of potash and the ashes of cotton seed hulls have both produced results inferior to the other forms.

The following table gives the comparative results for four years :

RESULTS OF FOUR YEARS COMPARED.—NITROGENOUS MANURES.

		1886. Plant.	1887. Stubble.	1888. Plant.	1889. Stubble.	Average.
1. Mixed minerals, ⅓ ration of cotton meal	Yield per acre	....	19.18	26.83	22.75	22.92
	Sucrose	15.7	12.2	13.2	11.1	13 05
	Glucose	....	1.45	.83	1.32	1.2
	Lbs. available sugar	....	2,695	4,492	2,905	3.364
2. Mixed minerals, ⅔ ration of cotton meal	Yield per acre	....	22.4	26.25	24 85	24.5
	Sucrose	14.5	11.6	13	11.1	12.55
	Glucose	....	1.82	.89	1.28	1.33
	Lbs. available sugar	....	2,780	4,289	3,194	3,421
3. Mixed minerals, ⅔ ration of fish scrap	Yield per acre	....	17 7	25.55	19.09	20 78
	Sucrose	11.7	13.1	.....	11 8	.....
	Glucose	....	1.11	.....	1 08	.....
	Lbs. available sugar	....	2,816	.....	2,720	.....
4. Mixed minerals, ...	Yield per acre	....	1.24	19.07	14 03	15 17
	Sucrose	1.29	12.2	12.2	12.2	12 37
	Glucose	....	1.56	.7	1 04	1.1
	Lbs. available sugar	....	1,719	2,979	2,050	2,249
5. Mixed minerals, ⅔ ration of fish scrap	Yield per acre	....	20.33	25.2	19.65	21.73
	Sucrose	13.5	12.7	12.9	12.3	12 85
	Glucose	....	1.56	.75	1 13	1 15
	Lbs. available sugar	....	2,948	4,156	2,917	3,307
6. Mixed minerals, ⅓ ration of dried blood	Yield per acre	....	26	21.81	18 66	22.16
	Sucrose	14	11 5	.....	11.3	.....
	Glucose	....	1.8	.....	1 07	.....
	Lbs. available sugar	....	3,203	.....	2,532	.....
7. Mixed minerals, ⅔ ration of dried blood	Yield per acre	....	26.84	22.75	22.79	24 12
	Sucrose	12.8	10.4	13.2	11.3	11.93
	Glucose	....	1.6	.81	1.42	1 28
	Lbs available sugar	....	3,006	3,822	2,926	3,251
8. Mixed minerals, ⅓ ration of sul. ammonia	Yield per acre	....	21.31	23.8	19 68	21 59
	Sucrose	13.1	11.5	13.1	11 2	12 23
	Glucose	....	1.8	.79	1.07	1 22
	Lbs. available sugar	....	3,203	3,975	2,640	3,273
9. Mixed minerals, ⅔ ration of sul. ammonia	Yield per acre	...	29	23.56	22 7	25 8
	Sucrose	12.9	10.4	13.4	11.1	11 95
	Glucose	...	2	.8	1.38	1 39
	Lbs. available sugar	....	3,004	4,029	2,870	3,301
10. No manure........	Yield per acre	....	15.22	17 87	12 81	15 3
	Sucrose	13.1	10.8	12.6	10.7	11 8
	Glucose	....	1.8	.65	1.23	1 22
	Lbs. available sugar	....	1,726	2,913	1,588	2,076
11. Mixed minerals ⅓ ration of nitrate soda	Yield per acre	...	27.4	20.55	17.05	22 33
	Sucrose	13	10 6	12.9	12	12 13
	Glucose	....	2	.62	1	1.21
	Lbs. available sugar	....	2,913	3,411	2,505	2,943
12. Mixed minerals, ⅔ ration of nitrate soda	Yield per acre	....	21.77	24.85	21.51	22.71
	Sucrose	11.4	8.8	11.6	11.4	10 8
	Glucose	....	2.42	.72	1.11	1 41
	Lbs. available sugar	....	1,576	3,653	2,941	2,723

FORMULAS FOR CANE.

Another part of Plat 14 was devoted to the trial of various formulas hitherto given to the public as adapted to cane.

No. 13, consisting of—

130 pounds nitrate of potash,

650 pounds acid phosphate,

510 pounds gypsum,

is prescribed by Prof. George Ville, of the government school at Vincennes, France, as specially adapted to plant cane. It is an expensive compound and experience here has shown excessive in phosphoric acid and deficient in nitrogen.

No. 14 is a formula prescribed by the Experiment Station upon St. Denis, on the island of Reunion (formerly Bourbon), and is highly endorsed by the planters of this island and Mauritius. It too is expensive and the quantity per acre much in excess of the ordinary requirements of our crops. It is as follows:

No. 14—

140 pounds sulphate of ammonia,

100 pounds nitrate of soda, 120 pounds dried blood,

560 pounds acid phosphate,

80 pounds muriate potash.

Here the nitrogen is presented in three forms, which is believed to best meet the requirements of the plants.

Nos. 15, 16 and 17, which were fertilized last year respectively with Ohlendorff's "A" Special Cane Manure, "B" Early Cane Manure, and "C" Dissolved Peruvian Guano, were this year as stubble, in default of these goods, treated with the following mixtures:

No. 14—

720 pounds cotton seed meal.

500 pounds acid phosphate.

320 pounds kainite.

No. 16—

720 pounds cotton seed meal.

500 pounds acid phosphate.

80 pounds muriate of potash.

No. 17—

720 pounds cotton seed meal.

500 pounds acid phosphate.

80 pounds sulphate potash.

YIELDS OF 1888 AND 1889.—PLAT 14.

		1888. Plant.	1889. Stb'le.
13. Ville's Formula	Yield per acre	26.01	15.65
	Sucrose	13.2	11
	Glucose	.84	1.31
	Pounds available sugar	4,357	1,979
14. St. Denis Formula	Yield per acre	30.05	21.56
	Sucrose	13.1	10.9
	Glucose	.9	1.32
	Pounds available sugar	4,943	2,692
15. Ohlendorf's Special Cane Manure in 1888	Yield per acre	29.16	20.82
	Sucrose	11.7	11.2
Meal phosphate with Kainite in 1889	Glucose	.9	1.22
	Pounds available sugar	4,225	2,731
16. Ohlendorf's Early Cane Manure in 1888	Yield per acre	24.73	19.13
	Sucrose	12.4	11.4
Meal Phosphate with Muriate Potash in 1889	Glucose	.91	1.47
	Pounds available sugar	3,825	2,462
17. Ohlendorf's Dissolved Peruvian Guano in 1888	Yield per acre	22	20.88
	Sucrose	15.7	10.9
Meal Phosphate with Sulphate of Potash in 1889	Glucose	.85	1.22
	Pounds available sugar	3,527	2,651

The St. Denis formula has furnished the largest tonnage each year, while No. 15 has given this year the largest sugar yield. The fertilizers used in Nos. 15, 16 and 17 are far cheaper than those prepared by the foreign formulas, and give equally as good results. Ville's formula is deficient in nitrogen and excessive in phosphoric acid, while St. Denis is excesssive in both; both nitrogen and phosphoric acid in Nos. 15, 16 and 17 were greatly in excess of requirements last season, this being an unusually dry one.

WHAT PROPORTIONS SHALL NITROGEN AND PHOSPHORIC ACID BE COMBINED FOR CANE?

A part of Plat 14 was used for these experiments.

The object of these experiments was to determine, if possible, the proportions in which cotton seed meal and acid phosphate should be mixed to give the best results on cane.

Cotton seed meal has been used alone on experiment 18. In the other experiments it has been combined in such proportions with acid phosphate as to give the following ratios of nitrogen to phosphoric acid, viz: 1—3, 1—2, 1—1, 2—1, and 3—1. In this combination, no account has been taken of small amount of phosphoric acid in cotton seed meal, or of the still smaller

amount in the insoluble form in the phosphate. The nitrogen is reckoned at 7 per cent, in the meal, and the soluble phosphoric acid at 14 per cent. in the phosphate. The combination was used at rate of 750 pounds per acre. The following are the quantities used :

Experiment No. 18—	650 lbs. cot. seed meal	
" " 19—	300 " " " " 450 " acid phosphate	Nitrogen 1 to phosphoric acid 3
" " 20—	375 lbs. cot. seed meal 375 " acid phosphate	" 1 to " " 2
" " 21—	Nothing	
" " 22—	500 lbs. cot. seed meal 250 " acid phosphate	" 1 to " " 1
" " 23—	600 " cot. seed meal 150 " acid phosphate	" 2 to " " 1
" " 24—	650 " cot. seed meal 100 " acid phosphate	" 3 to " " 1

The results of both years are herewith given :

PLAT 14.

			1888 Plant.	1889 Stubble.
18	Cotton Meal (alone). Nitrogren 7 to Phosphoric Acid 3.	Yield per acre	18.69	20.23
		Sucrose	11.9	11.1
		Glucose	.71	1.19
		Pounds available sugar	2,839	2,638
19	Nitrogen 1 to Phosphoric Acid 3.	Yield per acre	19.48	19.79
		Sucrose	14.2	12.6
		Glucose	.39	1.04
		Pounds available sugar	3,623	3,059
20	Nitrogen 1 to Phosphoric Acid 2.	Yield per acre	20.07	19.85
		Sucrose	14.8	11.5
		Glucose	.56	.9
		Pounds available sugar	3,914	2,834
21	No Manure	Yield per acre	16.97	14.65
		Sucrose	11.4	12.8
		Glucose	.76	.91
		Pounds available sugar	2,435	2,345
22	Nitrogen 1 to Phosphoric Acid 1.	Yield per acre	22.75	18.53
		Sucrose	12.2	10.5
		Glucose	.75	.1
		Pounds available sugar	3,536	2,334
23	Nitrogen 2. to Phosphoric Acid 1.	Yield per acre	24.5	19.25
		Sucrose	13 4	11.5
		Glucose	.71	1.21
		Pounds available sugar	4,241	2,610
24	Nitrogen 3 to Phosphoric Acid 1.	Yield per acre	33.8	20.55
		Sucrose	13.4	11.3
		Glucose	.78	1.29
		Pounds available sugar	4,082	2,694

In 1888 No. 23, nitrogen two parts to phosphoric acid one part, gave the largest tonnage, and No. 20, nitrogen one part to

phosphoric acid two parts, the largest sugar content. In 1889 No. 24 gives the largest tonnage, and No. 19 the highest sucrose period.

TILED VERSUS UNTILED LAND.

In the fall of 1885 a plat of the blackest and stiffest land on the Station, and perhaps as black and stiff as any piece in the State, was selected for testing the efficacy of tiles in ameliorating the physical and chemical properties of such soils. This plat was four acres deep and nearly one acre wide. It was divided into two equal parts—one was tiled and the other left undisturbed. After completing the work there was no sign or indication of the line of demarcation between the two pieces. These tiles were laid four feet deep and twenty feet apart. The work was performed by Mr. Oakes, of Ohio, and was well done.

Early in the winter of 1885–'86 the plat was flushed and divided in two equal parts. The untiled part was named Plat No. IV, and the tiled, No. V. They were carefully bedded and planted in cane in the early spring of 1886. These plats were in stubble cane when we obtained the place, and we were told that it had been in succession cane for years.

The seed cane used was defective and the stand was poor, except on the first group. Hence, only this group was harvested this year. On account of the poor stand of 1886, the stubble was plowed up and land replanted in cane March 5, 1887. An excellent stand was obtained, which has subsequently been cultivated as first and second year stubble (1888 and 1889). The following are the manures used per acre on each plat:

No. 1. 500 pounds cotton seed meal.
500 pounds acid phosphate.
500 pounds kainite.

No. 2. 500 pounds cotton seed meal.
500 pounds acid phosphate.

No. 3. Nothing.

No. 4. 500 pounds cotton seed meal.
500 pounds natural phosphate.
500 pounds kainite.

No. 5. 500 pounds cotton seed meal.
500 pounds natural phosphate.

No. 6. Nothing.

No. 7. 500 pounds cotton seed meal.
500 pounds bone dust.
500 pounds kainite.

No. 8. 500 pounds cotton seed meal.
500 pounds bone dust.

No. 9. Nothing.

No. 10. 500 pounds cotton seed meal.
500 pounds floats.
500 pounds kainite.

No. 11. 500 pounds cotton seed meal.
500 pounds floats.

No. 12. Nothing.

No. 13. 500 pounds cotton seed meal.
500 pounds ashes cotton hulls.
500 pounds kainite.

No. 14. 500 pounds cotton seed meal.
500 pounds ashes cotton hulls.

No. 15. Nothing.

No. 16. 500 pounds cotton seed meal.

No. 17. 500 pounds acids phosphate.

No. 18. 500 pounds kainite.

No. 19. Nothing.

Both plats have received the identical treatment through the four years.

The accompanying table gives the results of the four years.

RESULTS PLAT 4 AND 5, UNTILED AND TILED LANDS.

	1886.		1887.				1888.				1889.			
	Tons per acre.	Sucrose.	Yield per acre, tons.	Sucrose.	Glucose.	Sugar per acre, lbs.	Yield per acre, tons.	Sucrose.	Glucose.	Sugar per acre, lbs.	Yield per acre, tons.	Sucrose.	Glucose.	Sugar per acre, lbs.
1. Untiled	6.72	12.1	18.92	12.2	1.06	2811	14.49	14.7	.65	2797	9.76	11 8	1.25	1356
Tiled	12.08	12 4	27.1	12.5	1.05	4144	22.49	13.6	1.1	3756	17.1	11.3	1.24	2259
2. Untiled	9.62	10.9	25	12.5	1.05	3823	20.44	13.7	1.07	3454	18.6	11.5	1.37	2459
Tiled	14.8	11.6	26.64	11.4	1.3	3524	25.99	....	....	....	18.3	12.	1.26	2590
3. Nothing	7.64	10.6	14.95	13	1.05	2600	9.75	....	....	....	6.3	12.3	1.18	928
4. Untiled	.....	....	23.26	12.4	1	3549	17.68	13.4	.91	2988	11.7	11.4	1.02	1617
Tiled	.....	....	26.14	12	1.05	3815	22.37	13.6	.67	3959	18.88	10.9	.98	3492
5. Untiled	.....	....	23.7	12.4	1.04	3596	16.89	14.6	.81	3158	12	12	1.26	1693
Tiled	.....	....	24.8	12.5	1.05	3793	23.52	13.7	.77	4163	15.9	10.6	1.28	1907
6. Nothing	.....	....	14.26	12.5	1.09	2160	10.43	13.9	.79	1888	4.7	12	1.23	663
7. Untiled	.....	....	20.16	13.6	.8	3330	16.45	13.9	.66	2961	11.86	11.3	1.02	1614
Tiled	.....	....	24.64	.....	....	....	21.93	13.9	.77	3925	18.02	12.3	1.08	2604
8. Untiled	.....	....	23.68	12	1.4	3198	18.87	14	.78	3378	13.6	12.3	1.21	1996
Tiled	.....	....	24.6	12.7	1.05	3831	20.04	....	....	....	14.36	11.8	1.14	2028
9. Nothing	.....	....	17.18	12.7	1.05	2675	10.43	12.6	.62	1700	3.2	12	1.13	462
10. Untiled	.....	....	15.94	12.3	1	2410	13.48	13.3	.69	2318	7.7	12.6	.83	1224
Tiled	.....	....	26.36	13	1	4234	16.66	13.6	.63	2949	16.32	12.5	.92	2540
11. Untiled	.....	....	19.96	12	1.35	2787	12.36	13.7	.98	2200	8.5	12.8	1.19	1310
Tiled	.....	....	22.91	12.5	1.05	3504	21.18	13.3	.53	3706	12	11.5	1.31	1601
12. Nothing	.....	....	14.86	13.9	.92	2604	9.1	13 1	.59	1557	3.5	11.8	1.3	482

13. Untiled	....	....	15.1	13.4	1.3	2420	9.45	14.6	.53	1824	5.8	12.5	1	892
Tiled	....	....	23 54	14.7	.6	4549	16.45	14.8	.58	3208	13.7	12	1.09	1988
14. Untiled	....	....	17.84	15	.9	3409	12.36	14.4	.47	2372	7.3	10.6	1.08	844
Tiled	....	....	20.06	12.8	.96	3190	17 61	15.3	.55	3575	12.6	12.1	1.1	1843
15. Nothing	....	....	13.78	12.9	1.04	2176	8.45	....	....	....	2.7	10.4	1.11	330
16. Untiled	....	....	16.1	14.1	.65	2978	9.8	12 3	.6	1568	3.76	11.8	1.3	518
Tiled	....	....	20.1	13.6	.78	3328	11.7	13.2	.61	2012	8.8	....	....	....
17. Untiled	....	....	12	11.1	1.04	1602	9 2	12 8	.54	1546	4.9	11.7	1.13	686
Tiled	....	....	15.92	13	.86	2609	12.99	11.3	.52	2455	7.16	11.3	1.27	941
18. Untiled	....	....	13.98	13.35	.77	2386	6.58	14.4	.57	1250	....	....	....	....
Tiled	....	....	19.17	12.6	.93	844	7.79	14.6	.53	1293	....	....	....	....
19. Nothing	....	....	14 82	13.7	1	2531	7.88	14.4	.54	1402	....	....	....	....

REVIEW OF RESULTS OF TILE DRAINED LANDS.

There are in the above two sets of experiments. The second set runs within a few feet of the tiles, and hence, the benefits of the latter are plainly apparent in the results. The first set more nearly represents the true difference between tiled and untiled lands. Taking the difference of yield for each year we have—

FIRST SET.	Tons cane.		Lbs. available sugar.
Increase per acre of tiled over untiled for 1886	5.36		
Increase per acre of tiled over untiled for 1887	6.23	and	909
Increose per acre of tiled over untiled for 1888	6.06	and	758
Increase per acre of tiled over untiled for 1889	7.05	and	1,236
Average increase for the four years.........	6.17	and	968
SECOND SET.			
Increase per acre of tiled over untiled for 1886	5.18		
Increase per acre of tiled over untiled for 1887	2.58	and	357
Increase per acre of tiled over untiled for 1888	2.68	and	551
Increase per acre of tiled over untiled for 1889	2.64	and	336
Average increase for the four years.........	3.27	and	415
Average increase of both sets for four years	4.72	and	691

	Tons.
The aggregate yield of first set tiled per acre for four years........	61
The aggregate yield of first set untiled per acre for four years......	41
The aggregate yield of second set tiled per acre for four years......	58½
The aggregate yield of second set untiled per acre for four years....	47
The aggregate yield of both sets tiled per acre for four years......	59¾
The aggregate yield of both sets untiled per acre for four years....	44
	Per cent.
The increase per cent. of first set tiled over untiled................	48
The increase per cent. of second set tiled over untiled.....	24
The increase per cent. of both sets tiled over untiled...............	36

It may, therefore, be truly said that the increase in cane upon lands well tiled will be from 25 to 50 per cent. upon similar lands not tiled. These tiles are twenty feet apart, the distance recommended by many experienced engineers.

The actual benefits just enumerated are sufficient recommendations for the drains; but to them must be added that lands tile-drained are made warm, sweet and mellow; roots penetrate easier and deeper, and thus provide themselves with better apparatus for procuring water in times of drouth. In wet weather the excess is drained off, instead of being evaporated. Evaporation is a cooling process, requiring much of the heat of the soil. Again it takes a much larger quantity of heat to warm up a soil filled with water than a dry one. Water is also a poor conductor of heat, and, therefore, wet soils are warmed downward very

slowly. As water drains from a soil air enters it and aids in warming. Snow melts at least a week earlier, on an average, upon drained than on undrained land similarly situated, Vegetation advances far more rapidly on drained land. Stiff soils are made open and porus, easier worked, and earlier handled after rains. The time and labor saved in a few years will pay for the tiles. The open ditches are objectionable for many reasons, some of which are constant cost of cleaning, waste of land, plowing can only be done one way, the loss of the cream of the soil by being constantly washed in small particles through the quarter drains into the ditches, and thence into the canal and swamps.

Drainage is of the first importance to the sugar planter, since cane revels in well drained land. The successful sugar planter recognizes the necessity of drainage, and a heap of it. Year before last there fell on this station 75 inches of rain. Each inch represents 27,154 gallons of water per acre, or in round numbers 2,036,550 gallons, or 8,485 tons by weight per acre for the year. This would give an average of 25 tons of water to be evaporated daily from each acre of land did none run off the surface. If it run off what a powerful eroding and carrying power on our soils! If, as our engineers say, one pound of coal will evaporate eight pounds of water, it would require over three tons of coal per day for each acre of land throughout the year to evaporate the water which falls on it. This enormous rainfall forces the necessity of drainage. But which is best, surface drains, with loss of soil, or under drains, which not only relieve the soil of excess of moisture, but make it warm and mellow? Tile drainage, like diffusion, is surely but slowly coming.

PLAT 15.—PEA VINES REMOVED VERSES PEA VINES TURNED UNDER.

In the spring of 1886 plat 15 was sown broadcast in cow peas. A luxuriant growth of vines was obtained. The plat was divided into two equal parts. The vines were removed on the west half, and fed to stock. The entire plat was then fallowed

with four horse plow, and cane planted in October, 1886. This gave a basis for similar experiments with and without pea vines. In order to determine the chemical value of the latter, together with its roots, the following experiment was made: A square 10x10 feet near the centre of the plat and fairly representing the average of the crop, was selected, and the vines carefully removed by a scythe. These were at once weighed, and thoroughly dried and analyzed. Around this plat a ditch eighteen inches deep was dug, and with a strong spray pump, the roots were patiently washed up. It required three days with three laborers to successfully perform the operation. The vines were nearing maturity and had passed the period most desirable for hay making.

The following are the results with analyses:

	lbs.
Amount of green vines removed per acre	21,345
Amount of roots washed up per acre	3,464
Total green matter removed per acre	24,809
When thoroughly dried, the vines weighed	3,330
When thoroughly dried, the roots weighed	1,040
Total dry matter per acre	4,370

It is proper to add here, that despite our careful efforts, a considerable quantity of the small rootlets escaped us. The following are the analyses:

	Organic matter.	Ash.	Nitrogen.	Potash.	Phos. acid.	Lime.
Dried vines	90.26	9.74	1.7	2.77	.48	1.01
Dried roots	92.58	7.42	.8	1.74	.43	.97

Applying the above, one acre of cow peas turned under gives to the soil 3970.38 pounds organic matter, containing 64.95 pounds nitrogen, 20.39 pounds phosphoric acid, 110.56 pounds potash, and 42.6 pounds lime. Removing the vines for stock feed, leaves in the roots at least 965 pounds organic matter, containing 8.34 pounds nitrogen, 4.43 pounds phosphoric acid, 18.1 pounds potash. and 10.16 pounds lime. Good cotton seed meal contains 7 per cent. nitrogen, 3 per cent. phosphoric acid,

and 2 per cent. potash and kainite, 12 per cent. of potash. Therefore the vines and roots combined contain more nitrogen than is contained in 900 pounds of cotton seed meal, and more potash than is in the same amount of meal, additioned by 700 pounds kainite. This amount of meal would contain a few pounds more of phosphoric acid than is found in the peas.

Removing the vines for feed would, therefore, decrease the supply of plant food to the acre, by the following amounts: Nitrogen, 56.61 pounds; phosphoric acid, 15.96; potash, 92.46 pounds—amounts about equal to that contained in 800 pounds cotton seed meal, and 640 pounds kainite.

Therefore in removing the vines there is certainly a removal of a large supply of valuable plant food. Will the cane plant testify to the same fact? To decide this question, duplicate experiments were made upon each half of the plat. All the factors of planting, fertilizer, and cultivation were identical—the only variation was the "vines removed on one" and "turned under on the other."

There were other incidental questions also asked of this plat, but this was the leading object. These experiments, begun with plant cane in 1887, have been continued in 1888 and 1889 as first and second year stubble.

The table following gives the results for 1889, second year stubble.

This plat was harvested Oct. 3, and was too green to be successfully manipulated in the sugar house. The syrup could not be grained in the pan.

RESULTS PLAT XV. — SECOND YEAR STUBBLE — HARVESTED OCTOBER 3.

Manures Used Per Acre.	Disposition of Pea Vines	Yield Per Acre in Tons.	Analyses.			Purity coefficient.	Glucose ratio.	Pounds available sugar on 70 per ct. extraction.	
			Total solids.	Sucrose.	Glucose.			Per ton	Per acre
1. 500 lbs. Cot. Seed Meal, 250 lbs. Acid Phosphate, 100 lbs Kainite	Turned in	16.03	11.9	8.2	3.03	69	36.95	47.4	760
1. Ditto	Removed	16.02	10.9	6.4	3.48	59	54.37	16.5	264
2. 500 lbs. Cot. Seed Meal, 500 lbs. Acid Phosphate, 100 lbs Kainite	Turned in	17.17	10.7	6.6	3.44	62	52.33	20.2	346
2. Ditto	Removed	16.45	10.4	7.6	3.36	73	44.21	35.8	590
3. 500 lbs. Cot. Seed Meal, 250 lbs. Acid Phosphate	Turned in	15.99	10.9	7	3.06	64	43.71	33.7	540
3. Ditto	Removed	14.88	11	6.6	3.37	68	51.06	31.6	322
4. 500 lbs. Cot Seed Meal, 500 lbs. Acid Phosphate	Turned in	17.05	11.7	6.4	3.41	55	53.28	18	307
4. Ditto	Removed	14.37	11.6	7.1	3.59	61	50.56	24.1	346
5. No manure	Turned in	11.41	11.8	7.3	3.42	62	46.84	30.4	347
5. No manure	Removed	10.54	11	6.6	3.33	60	50.45	22.5	237
6. No manure	Turned in	11.52	11.8	7.3	3.48	62	47.67	29.1	335
6. No manure	Removed	10.7	10.6	5.7	3.55	54	62.38	5.3	56
7. 100 lbs. Nitrate Soda, 70 lbs. Sulph. Am., 150 lbs. Cot. Seed Meal, 300 lbs Acid Phosphate, 100 lbs. Kainite	Turned in	17.95	9.5	4.8	3.51	50	73.12	....	...
7. Ditto	Removed	17.57	10.7	5.5	3.33	51	60.54	7.1	124
8. 300 lbs. Nitrate of Soda, 300 lbs. Acid Phosphate, 100 lbs. Kainite	Turned in	17 26	10.7	5.5	3.33	51	60.54	7.1	122
8. Ditto	Removed	15.54	10.7	5.6	3.57	52	63.74	3.5	53
9. 100 lbs Sulph. Am., 200 lbs Dried Blood, 300 lbs. Acid Phosphate, 100 lbs Kainite	Turned in	17.25	10.7	6	3.57	56	59.5	9	156
9. Ditto	Removed	18.06	10.5	5.8	3.7	55	63.79	3.5	63
10. 200 lbs. Sulph. Am., 300 lbs. Acid Phosphate, 100 lbs. Kainite	Turned in	17.68	10.5	5.8	3.7	55	63.79	3.5	62
10. Ditto	Removed	15.83	10.6	5.3	3.85	50	72.64	....	...

RESULTS FOR THREE YEARS.

Taking the experiments with no manure, and where no known errors have influenced results, we have obtained the fol-

flowing per acre due to pea vines turned under:

In 1887, 2.91 tons; in 1888, 3.69 tons, and 1889, .82 tons. Total, 7.42 tons.

Taking the entire plat, with several known modifying errors, we have, in 1887, 2.23 tons; in 1888, 1.08 tons, and 1889, .94 tons. Total, 4.25 tons.

The former increase is perhaps nearer the actual gains than the latter. The vines removed would have given about two tons per acre of cured hay, worth, after the expenses of harvesting is deducted, \$5 per ton, or \$10 per acre. They were worth as a fertilizer the equivalent of 800 pounds cotton seed meal and 640 pounds kainite. The former is now worth \$20 per ton and the latter \$15, and these would give a fertilizing value to pea vines of \$12.80.

From this investment there has been an increase of 7.42 tons cane, worth, say, \$4 per ton, or \$29.68 per acre. It is believed that the average results from pea vines turned under are even higher than those obtained here.

However, the results obtained show conclusively that removing the pea vines for hay is to the detriment of subsequent crops, even to the third year.

The incidental questions involved in the above experiments are corroborative of others answered elsewhere. 1. Potash in small quantities is without effect on these soils. 2. That excessive quantities of phosphoric acid are without beneficial results. 3. That while sulphate of ammonia has given slightly better results, the increase is so slight and the price of this article proportionately so dear, that any form of nitrogen usually offered on our market can be used with safety by our planters. 4. That stubble cane makes just as good seed as plant.

PLAT 2—POPULAR MANURES.

In 1886 this plat was planted and fertilized with the following popular manures: Cotton seed meal, acid phosphate, kainite, Charleston floats, gypsum, cotton hull ashes, tankage, and cotton seed. These experiments have been continued to third year stubble and one remarkable fact has been shown conclusively by them, viz.: that when the proper manure in appropriate quantities has been used yearly, a profitable crop of third year stubble has been gathered. When an improper fertilizer has been used, or the soil has received no fertilizer, no crop has been gathered. An inspection of the following table will show this:

RESULTS OF PLAT 2—THIRD STUBBLE, 1889.

	Manures Used Per Acre.	Yield per Acre in Tons	Analyses. Total Solids	Analyses. Sucrose.	Analyses. Glucose.	Coefficient of Purity.	Glucose Ratio.	Lbs available sugar on 70 per cent. extraction. Per Ton.	Lbs available sugar on 70 per cent. extraction. Per Acre.	When Harvested.
1	200 lbs. Cotton Seed Meal 100 lbs. Acid Phosphate	5.5	13.5	9.3	2.78	69	29.3	71.8	396	October 15.
2	333 lbs. Cotton Meal 167 Acid Phosphate	8.64	12.8	9.1	2.82	71	31	63.2	589	" "
3	140 lbs. Sulphate Am. 120 lbs. Dried Blood 200 lbs. Cot. Seed Meal 460 lbs. Acid Phosphate 80 lbs. Muriate Potash	19.06	12.3	8.5	2.97	69	34.9	56.6	979	" "
4	466 lbs. Cotton Meal 234 lbs. Acid Phosphate	17.2	12	7.7	3.06	64	39.7	43.5	997	" "
5	600 lbs. Cotton Meal 300 lbs. Acid Phosphate	21.16	12.8	9.4	2.79	73	29.7	73	1545	" "
6	600 lbs. Cotton Meal 300 lbs. Acid Phosphate 300 lbs. Kainite	8.74	11.8	8	2.12	68	26.5	67.5	589	" "
7	600 lbs. Cotton Meal	5.78	13.3	9.6	2.51	72	26.1	81.7	472	" "
8	260 lbs. Sulphate Am. 460 lbs Acid Phosphate 80 lbs. Muriate Potash	7.05	12.5	8.5	2.36	68	27.8	69.4	489	" "
9	300 lbs. Acid Phosphate 300 lbs. Kainite	2.2	......	......	......	......	......	......	......	" "
10	300 lbs. Kainite	1.8	......	......	......	......	......	......	......	" "

11	200 lbs. Cotton Seed Meal 100 lbs. Floats	.6	......	......	......	......	......	......	......	" "
12	333 lbs. Cotton Seed Meal 167 lbs Floats	1.8	......	......	......	......	......	......	......	" "
13	No Manure	.9	......	......	......	......	......	......	......	" "
14	466 lbs. Cotton Seed Meal 234 lbs. Floats	.3	......	......	......	......	......	......	......	" "
15	600 lbs. Cotton Seed Meal 300 lbs. Floats	16.49	12.5	9	2.76	72	30.7	65.2	1076	" "
16	600 lbs. Cotton Seed Meal 300 lbs. Floats 300 lbs. Kainite	16.23	11.5	8.4	2.08	73	21.8	73.9	1200	" "
17	600 lbs. Cotton Meal 300 lbs. Floats 300 lbs Kainite 200 lbs Gypsum	15.16	10.1	6.7	2.38	66	35.5	43.8	664	" "
18	No Manure	.8	......	......	......	......	......	......	......	" "
19	600 lbs. Cotton Meal 300 lbs. Floats 300 lbs. Cotton Hull Ashes	6.36	12.7	8.2	3.24	64	39.5	46.8	321	" "
20	300 lbs Tankage	2.2	12.9	9.1	2.35	70	25.8	78	772	November 25
21	450 lbs. Tankage.	2.28	13.4	10.6	2.36	79	20.3	98.8	226	" "
22	700 lbs Tankage	3.53	13.2	10.4	2.14	77	25.8	100.6	355	" "
23	No Manure	......	......	......	......	......	......	......	......	Few Stalks
24	900 lbs. Tankage	10.62	12.4	9.2	2.45	74	26.6	77.4	821	November 25
25	900 lbs. Tankage 300 lbs. Kainite	13.44	12.7	9.3	2.03	73	21.8	87.6	1177	" "
26	900 lbs. Tankage 300 lbs. Kainite 200 lbs. Gypsum	11.84	14	11.3	1.72	80	15.2	12.3	1445	" "
27	900 lbs. Tankage 300 lbs. Cotton Hull Ashes	1.1	......	......	......	......	......	......	......	" "
28	No Manure	1.1	......	......	......	......	......	......	......	" "
29	1700 lbs. Cotton Seed (Raw)	2.78	......	......	......	......	......	......	......	" "
30	1700 lbs Cotton Seed (Raw) 300 lbs. Acid Phosphate	7.3	......	......	......	......	......	......	......	" "

RESULTS PLAT 2—THIRD STUBBLE, 1889.—CONTINUED.

Manures Used Per Acre	Yield per Acre in Tons	Analyses. Total Solids	Analyses. Sucrose.	Analyses. Glucose.	Purity Coefficient.	Glucose Ratio.	Lbs. available sugar on 70 per cent. extraction. Per ton.	Lbs. available sugar on 70 per cent. extraction. Per Acre.	When Harvested.
31 1700 Cotton Seed (Raw) 300 lbs. Acid Phosphate 300 lbs. Kainite	5.6	......	......	......	......	......	......	......	" "
32 1700 lbs. Cotton Seed (Raw) 300 lbs. Cotton Hull Ashes	5.5	......	......	......	......	......	......	......	" "
33 No Manure	.9	......	......	......	......	......	......	......	" "
34 1700 lbs. Cotton Seed (Raw) 300 lbs. Floats	1.34	......	......	......	......	......	......	......	" "
35 1700 lbs. Cotton Seed (Raw) 300 lbs. Floats 200 lbs. Gypsum	1.3	......	......	......	......	......	......	......	" "

SUMMARY OF RESULTS FOR FOUR YEARS.

The four years just ended, have been patiently and industriously spent in the investigations of the many problems underlying the successful growth of sugar cane and its manufacture into sugar. While everything hoped for has not been attained, the little accomplished, supplemented by the consciousness of the rectitude of our intentions and that generous support yielded by an indulgent patronage, gives consolation and lends encouragement for renewed efforts in the future. Nature yields her secrets with great slowness, and only to those who apply aright, does she reveal them at all. Mindful that there are many, many facts yet to be learned before perfection in cane production can be attained, and relying upon that cordial support of the public so generously bestowed in the past, and a strong determination to accomplish its mission, the Sugar Experiment Station, in its new and handsome quarters, re-enters the experimental arena, confident of ultimate success.

The following are some of the conclusions taught by the results of the last four years:

1. That the upper portion of the cane is the equal, if not the superior to the lower part for seed, while the latter is vastly superior as a sugar producer.

2. That with good seed, two stalks and a slight lap will give an abundant harvest, and no more is needed.

3. That seed cane may be selected from either plant or stubble.

4. That suckering (tillering) is a natural function of all cereals and should be encouraged to produce the best results.

5. That rattoons come equally as well from suckers as from the original stalk.

6. That cutting cane in planting is not necessary to insure successful germination, the latter being dependent upon other conditions.

7. That the vital power of good sound eyes is enormous, enabling the latter under favorable conditions of heat, moisture,

and access of air to germinate at great depths, or even remain dormantly sound for over a year when properly protected.

8. That the present width of rows may be lessened (when the soil will permit of easy cultivation) with promise of increased production.

9. That several varieties of foreign canes promise adaptability to our wants.

10. That both nitrogen and phosphoric acid are needed by our soils to grow maximum crops of cane. That excessive quantities of each should be avoided, the former as being positively injurious and the latter as being redundant and wasteful.

11. That while sulphate of ammonia gives slightly the best results and fish scrap slightly the worst, it may be asserted that any form of nitrogen experimented with, will give remunerative returns when properly compounded, and used in such quantities as to furnish from twenty-five to fifty pounds nitrogen per acre.

12. That phosphoric acid, when applied at or after planting, should be in a soluble state, in quantities of thirty-two to sixty-four pounds per acre. Even the latter might, with propriety, be applied before the crop is planted. That insoluble phosphates should always be applied sometime in advance of the planting.

13. That no form of potash is preferred by the cane plant, and that small quantities neither increase the tonnage nor the sugar content.

14. That mineral manures (phosphates and potash) when applied alone, are without much effect; to be available they must be combined with nitrogen.

15. That nitrogen is most cheaply supplied to the planters of Louisiana in the form of cotton seed meal, and experiments have demonstrated that its profitable limits are between 300 to 600 pounds per acre under cane.

16. That tile drainage is a very valuable amendment to the soils of South Louisiana, and when properly done will pay a handsome dividend upon investment. Experiments indicate that best results are obtained when tiles are placed from twenty to thirty feet apart.

17. That pea vines turned under give an increased yield to the subsequent crops, extending even to the second year's stubble.

18. That the stubble from canes properly manured will give profitable crops for several years, while that unmanured, or unproperly fertilized, will fail in a year or two.

19. That manures can be prepared which will give tonnage, but no special manure has yet been found which will insure a large sugar content. The latter seems to be largely dependent upon soil, sunshine, temperature, moisture, and climate.

These are the deductions from the work of the past four years, and may be modified by future investigations.

The question of the proper manuring of cane is not yet settled. Seasons, particularly rainfall, modify the benefits of fertilizers. If one could accurately foretell the season, then manuring could be done with some degree of intelligence. It seems quite well established that manures should be applied in such quantities and proportions to meet the requirements of a vigorous growth from the time of germination until September. At that time all available plant food should be exhausted and growth should be suspended and the plant permitted to mature.

The proportions are independent of seasons, but the quantities assimilated by the plant are regulated almost entirely by the amount and distribution of rainfall. Therefore, what would be an excessive manuring in a very dry season, might prove inadequate to the requirements of a plant in a very favorable one. Our experiments indicate that from twenty-four to forty-eight pounds of nitrogen and forty to seventy-five pounds phosphoric acid to the acre, are the quantities which can be successfully assimilated during an average season. These are furnished by using from 350 to 700 pounds cotton seed meal combined with 300 to 600 pounds acid phosphate, and this mixture is recommended both on account of its cheapness and its efficacy. Upon new lands abounding in nitrogen or pea vine fallow (see Plat XV.) less nitrogen is required than upon stubble or succession cane. Equal mixtures will do for the first, while two or even three parts of cotton seed meal to one of acid phosphate may be required upon the lattar. Each planter should study his soils, and when found deficient in vegetable matter, should always increase his nitrogen.

There are very few seasons that will permit of the assimila-

tion by the plant of over 900 pounds of this mixture to the acre, and hence quantities above this should never be used. On the other hand, there are still fewer seasons when 500 pounds can not be easily assimilated, therefore a less quantity per acre will rarely ever be found profitable.

In the application of manure greater care is needed. It would by some means be thoroughly incorporated with the soil. The time of application is also important. Many planters apply nitrogenous manures at the time of planting and mineral manures when the cane is well advanced. There is no objection to an application, at least in part, of the nitrogenous manures at the time of planting, but there is a decided loss in postponing the application of mineral manures. They should by all means be applied at planting, or, even better, before planting. These do not leach from the soil, and the sooner applied the more diffusible they become in the soil. This is particularly the case with potash. Nitrogenous manures may be applied at planting and at any time during early growth.